DEVELOPMENTS IN DATA BASE TECHNOLOGY

INPUT

About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services (software, processing services, turnkey systems, systems integration, professional services, communications, systems/software maintenance and support).

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

INPUT OFFICES

North America

Headquarters
1280 Villa Street
Mountain View, CA 94041
(415) 961-3300
Telex 171407 Fax (415) 961-3966

New York
Parsippany Place Corp. Center
Suite 201
959 Route 46 East
Parsippany, NJ 07054
(201) 299-6999
Telex 134630 Fax (201) 263-8341

Washington, D.C.
8298 C, Old Courthouse Rd.
Vienna, VA 22180
(703) 847-6870 Fax (703) 847-6872

International

Europe
INPUT LTD.
Piccadilly House
33/37 Regent Street
London SW1Y 4NF, England
01-493-9335
Telex 27113 Fax 01-629-0179

INPUT s.a.r.l.
29 rue de Leningrad
75008 Paris, France
01-44-80-48-43
Fax 01-44-80-40-23

Japan
FKI, Future Knowledge Institute
Saida Building,
4-6, Kanda Sakuma-cho
Chiyoda-ku,
Tokyo 101, Japan
03-864-4026 Fax 001-03-864-4114

DECEMBER 1988

DEVELOPMENTS IN DATA BASE TECHNOLOGY

INPUT®

1280 Villa Street, Mountain View, California 94041-1194 (415) 961-3300

Published by
INPUT
1280 Villa Street
Mountain View, CA 94041-1194
U.S.A.

Information Systems Program
(ISP)

Developments in Data Base Technology

UDBD • 426 • 1988

Abstract

The Data Management function of today's Information Systems organization is facing new issues and challenges. It is evolving from a technological support function to an organization-wide administration of the information networks underlying definition and structure.

In this report INPUT looks at the current state of the data management function, the tasks it performs, how its responsibilities are changing, the impacts of new technology, and its shifting role. The goal of this report is to raise awareness about the changing role of this function, to suggest and support objectives and priorities for the next few years, and to indicate how the function is changing due to the accelerating shift to relational data base technology. INPUT believes that the importance of the data management function needs to grow significantly, and with it the characteristics of the individuals who perform this critical task.

This report contains 79 pages and 40 exhibits.

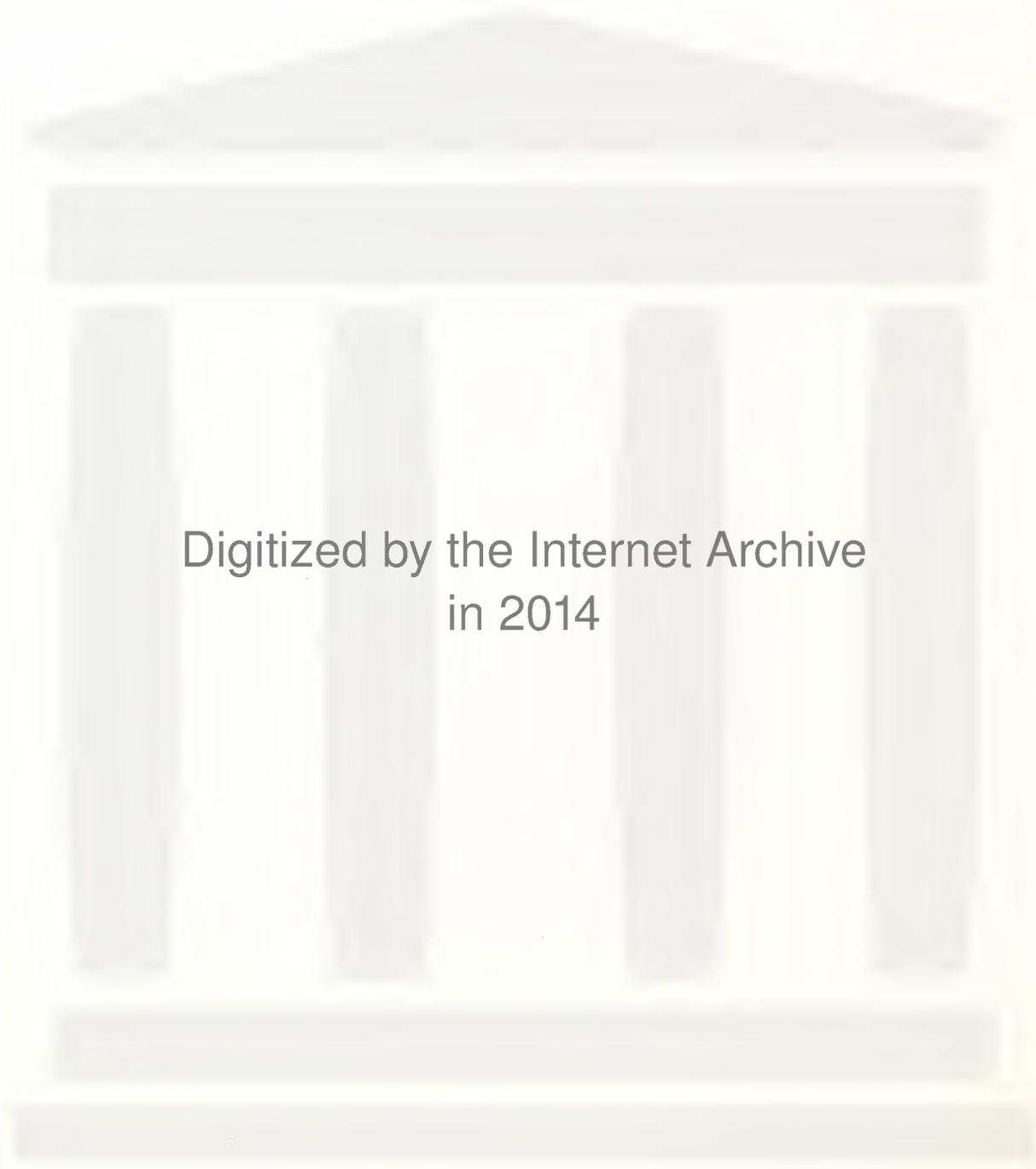


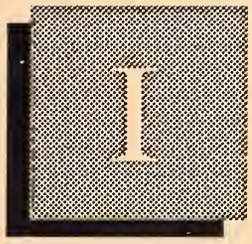
Table of Contents

Table of Contents (Continued)

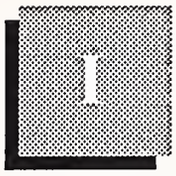
Table of Contents (Continued)

Exhibits

Exhibits (Continued)



Introduction



Introduction

A Overview

1988 will prove to be a year of debarkation for the data management function of the large information systems organization. After years of serving as the "technical controller" for data base management system (DBMS) based applications, the data management function now finds itself on the edge of major change. The fundamental DBMS technology is changing, those that develop DBMS-based applications are changing, and the information network of most organizations is quickly becoming distributed over three levels of computing.

No longer can the central information systems (IS) function and its data administration process focus only on the traditional hierarchical DBMS applications. The task of doing DBDs (data base design) and the other things a data base administrator has done are quickly becoming a small part of the data management process.

Consider the following:

- The installed base of IBM's relational data base management system, DB/2, has exploded to over 2000 over the past year and a half and is approaching the installed base of IBM's IMS and DL/1 hierarchical data base products.

- The fastest growing software companies include three that base their entire product lines on relational DBMS technology. They are Oracle, Sybase, and Relational Technology, the developer of Ingres.

- It is becoming common to place a relational DBMS on departmental minicomputers which originally used only file management systems. These computers are under the control of the end user, who is beginning to use relational data base technology.

- Unlike traditional DBMS technology, relational DBMSs from almost all vendors have adopted a standard language, SQL. The concept of

portability has been accomplished with the same DBMS and its applications running on all types of computers, from PCs to mainframes. Oracle's relational DBMS runs on almost any minicomputer, as well as under DOS on personal computers and under VM and MVS on IBM mainframes.

- Using the relational definition, it is now possible to distribute a data base across multiple computers. As distributed data base management system capabilities are proven and improved, the entire approach to application design will go through major change.

It is against this background of major change, and with the belief that data management is one of the most important obligations of the central information systems organization, that INPUT provides this status report on the data management function, *Developments in Data Base Technology*.

This report concludes that data management requires the concentrated attention of the senior information systems executive over the next five years.

B

Scope

This report looks at the data management function of information systems from organizational and process standpoints. The overall objectives are to characterize the current state of the data management function and to set a framework for information systems management to use in directing this function over the next few years.

1. Objectives

The specific objectives of this report and the related research were to:

- Identify the underlying trends and issues in the data management area relative to technology, responsibilities and resources
- Track progress with relational DBMS technology and its use by both information systems and end users
- Assess the status of distributed data base and other related technologies such as the data base computer and the data dictionary
- Understand the magnitude of change that is impacting the data management function
- Set objectives for the data management function and its management for the 1990s

2. Definitions

The following terms and definitions will be used throughout this report.

- Data Management—The broad, overall process of providing a definitional basis for the information network of the organization. The data management process incorporates the elements of data architecture, data administration, and data definition in a technical and non-technical sense.

  The term data management will also be used to refer to the organization that addresses the overall data management process.

- Data Administration—The more traditional definition of the data control process that addresses the technical definition and control tasks required by DBMS technology, in particular the traditional data base management systems.

- Data Base Administrator (DBA)—Both the task and the specific job assignment of the individual who establishes the detailed definition logic required in programming a DBMS application.

- Relational Data Base Management System (RDBMS)—Those data base management systems that are based on the SQL language standard and that provide the flexible, table-like, view of data relationships.

- Traditional Data Base Management System (DBMS)—Those traditional data base management systems that are hierarchical or use the Codasyl standard for specifying data relationships.

- Three-Tiered Computing Network—INPUT uses a three-part (tier) structure to define the computing/information network of most organizations. Tier one is the central or mainframe tier. Tier two is the middle level and is usually minicomputer based. Tier three is the workstation, which more and more commonly is becoming a computer not a terminal.

C Methodology

To gain an understanding of the state of the data management function INPUT undertook a significant interview task. One hundred data base managers were interviewed using the questionnaire in Appendix A. That questionnaire was designed to:

- Assess current status of the data management organization. What are the major issues and how is the job of the data management function changing.

- Determine the current DBMS environment; who is being served and what DBMSs are being supported.
- Identify the level and type of application development activity with relational and distributed DBMS technology.
- Learn whether, and how, the end user was using DBMS technology on mainframe and minicomputers.

In addition, a few data managers were interviewed using Questionnaire #2 (Appendix B). This second questionnaire is planned for further 1989 research into the impacts of new data base technology.

Both of the Data Administration Questionnaires are also designed for use by information systems management to assess its data management function and to position it against this research. How does your data management process compare with the findings and proposed direction in this report?

1. Research Demographics

The focus of the research was the data management of larger, Fortune-500-sized information systems organizations. In addition, the targeted audience for the interview was the data manager within the "central" or corporate information systems organization. INPUT wanted to understand data management from the central point of view, not that of an operating division that has its own data administration staff performing the DBA function.

The 100 data managers came from the ten industry sectors listed in Exhibit I-1.

EXHIBIT I-1

RESEARCH DEMOGRAPHICS
INDUSTRY SECTORS

Discrete Manufacturing	Insurance
Process Manufacturing	Banking & Finance
Transportation	Medical
Utilities	Services
Retail	Wholesale Distribution

2. Other Research

Other research includes an in-depth search of the current published information, the research for the 1987 report *Distributed Data Base—An Early Look*, and conversations with DBMS vendors concerning their objectives, strategies and challenges.

In addition this report draws on a survey of 100 application development managers conducted in 1988 by INPUT. The questionnaire for this research is included as Appendix C and the findings are used primarily in Chapter IV, "Impacts of Relational Data Base Technology".

D

Report Structure

The remaining chapters of this report address the following topics.

- Chapter II—Executive Overview: a summary of the findings and conclusions of this report.
- Chapter III—Data Management: Current Environment: a status report on the central data management function.
- Chapter IV—Impacts on Relational Data Base Technology: a status report on the adoption of RDBMS technology and the implications for data management.
- Chapter V—Impacts of Other Data Base Technology: a look at distributed data base technology, the data dictionary and the relationship to computer-assisted systems engineering (CASE).
- Chapter VI—Data Management: Future Environment: INPUT's proposal for data management's role in the information systems function in the 1990s.
- Chapter VII—Conclusions and Recommendations: INPUT's conclusions from its research and recommended priorities for senior information systems management relative to the data management function for 1989 and the first few years of the next decade.

E

Related Reports

The following INPUT reports were used in this study and provide added information for the reader.

- *Distributed Data Base Management—An Early Look*
- *DBMS Markets, 1987-1992*
- *Information Systems Planning Report, 1988*

- *Computer-Assisted Systems Engineering, Markets, and Opportunities*
- *Workstation Strategies*

Executive Overview

II

Executive Overview

This chapter provides an overview of the report. This assessment of the state and future direction for the data administration and management process is based on interviews with 100 managers of data administration functions. Those managers were primarily members of the central information systems function.

The fundamental conclusion of this report is that the data administration process must undergo fundamental expansion in orientation because of both technological change and the need for a tightly integrated yet distributed information network. The historic technical and mainframe orientation will not support the information network needed and expected in the 1990s.

A Changing Environment

After 15 years of evolution along a relatively singular path, the information-systems-based data administration function is in the process of major change. Exhibit II-1 identifies the sources of this significant change.

EXHIBIT II-1

DATA ADMINISTRATION— CHANGING ENVIRONMENT

- Shift to Relational DBMS
- Multiple DBMS Environments
- DBMSs at All Three Tiers of Computing
- End User Access to Data Managed by DBMSs
- Additional DBMS Technology on the Horizon

Today's information network is shifting from traditional to relational data base management technology. The learning curve is starting over.

The shift to RDBMS is causing data administration to become multilingual, understanding multiple data base structures and languages and building interfaces between them.

The data base focus has moved from the central mainframe, the domain of the DBA, to all three tiers; however, the data administration process has not expanded with this movement.

Expanding end-user capabilities are leading users to access primary data bases and transfer data to departmental computers or workstations—without an understanding of fundamental data base concepts.

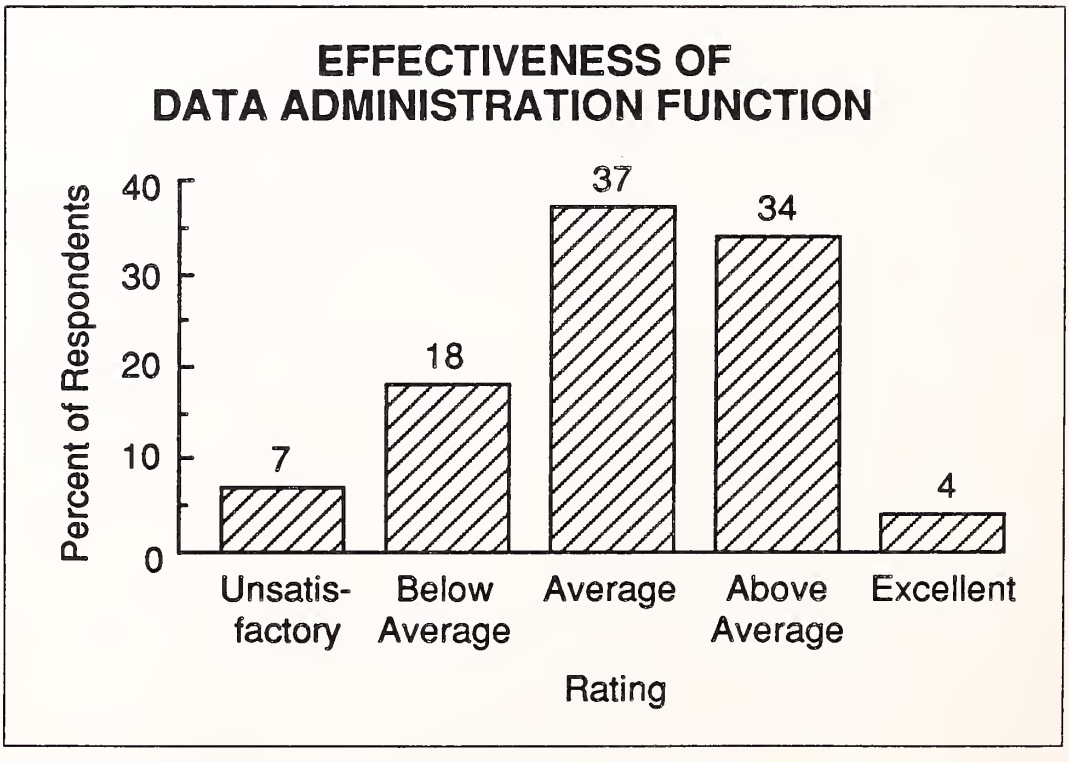
Even before relational DBMS is in full use, expanded capabilities are being released. The most significant of these will prove to be distributed DBMS technology.

B

Effectiveness of Data Administration

As information systems moves into the era of relational DBMS, with data base capabilities at all levels of the information network, it finds its control function, data administration, less than adequately prepared. Exhibit II-2 shows, as measured by the manager, the effectiveness of the data administration functions examined.

EXHIBIT II-2



With the majority of respondents rating themselves average or below average, and one in four indicating below average performance, it be-

comes apparent that this function warrants increased attention from information systems management as it prepares to enter the 1990s.

Data administration faces some perplexing issues over the next few years and yet finds itself without the essential tools required to do its job today. Only eight out of ten data administration groups are using a data dictionary and only half of those claim to have 100% of the data bases administered by the data dictionary. And where it is in full use, the dictionary routinely addresses only the central or mainframe data bases.

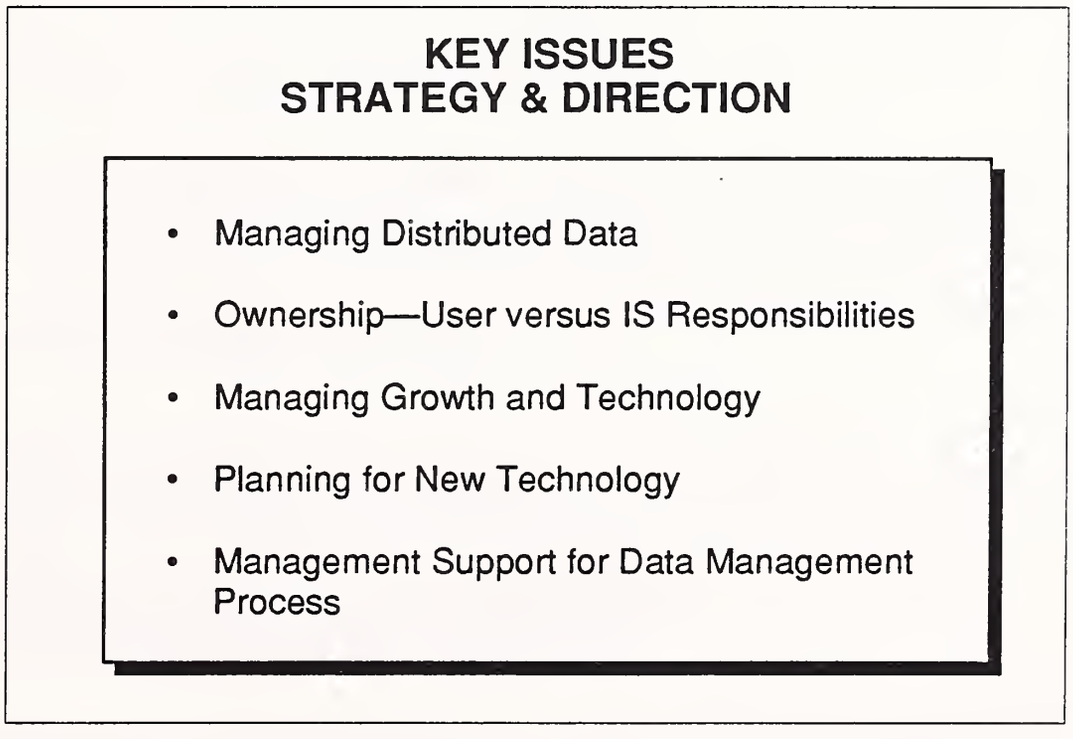
C

Key Issues

When asked about the key issues and challenges facing their data administration function, the managers most often (at least twice as often as other responses) mentioned the uncertainty about strategy and direction. They recognized that there is more they should be doing and that the data base technology is changing around them, but they are uncertain about which way they are to move.

Exhibit II-3 lists the subissues that make up this concern about strategy and direction. Since data administration is often considered a technical support function usually managed by a technical person, data adminstrators await clear direction, yet it appears that information systems management is not providing that direction.

EXHIBIT II-3



D

RDBMS and Data Administration

The level of use of relational DBMS is exploding. From a level of experimentation in 1987 to a level of almost complete dominance of new development activities, relational DBMS is quickly becoming the DBMS technology of choice.

- Over 60% of the organizations indicate they are building relational DBMS applications.
- Over 50% report that more than half of their mainframe new application development is being done with relational technology.
- Relational technology is being used for both new types of applications (e.g., executive information systems) and traditional accounting and operational systems.

The impacts of relational DBMS use on data administration include those listed in Exhibit II-4. Not only is data administration faced with a new technology, but also with a new client base, the end users, which is learning to use relational technology faster than traditional DBMS systems.

EXHIBIT II-4

IMPACTS OF RDBMS ON DATA ADMINISTRATION

- Administering a Dual DBMS Environment
- Training, Both Technical and Conceptual
- A New Client, the End User
- More Dynamic Data Administration Environment
- New Data Administration Support Tools

The movement to relational DBMS systems is starting a revolution that many data administration functions are not prepared to support.

E

Other Data Base Technologies

There are technological changes besides relational DBMS that are impacting data administration.

1. Distributed Data Base Management Systems

The developers of relational DBMS systems are already providing distributed DBMS capabilities. While there are major advantages in the distributed single data base concept, there remains much to develop and prove. Systems development and data administration are still learning to develop single-platform relational DBMS applications.

Distributed capabilities offer significant control benefits while also helping the user access needed information. It is reasonable to assume that these distributed capabilities will be put into use in the near future.

2. CASE

The move to introduce computer-assisted systems engineering (CASE) technology into the development function will directly impact data administration as well. CASE will bring the "repository" as the core facility for documenting everything about an application. This repository is a major step beyond the data dictionary that most organizations have failed to fully implement.

The success of CASE will depend heavily on how the data administration function accepts the capabilities and disciplines of CASE. CASE will not be a lasting success if it does not encompass the data management process.

3. Data Base Computers

The use of data base computers for specialized applications is enjoying modest growth. The technology has its use, but it must be remembered that use of a data base computer introduces yet another DBMS that must be learned and managed in the growing multiple-language environment of data administration.

F

Future Environment

The data management function required by the information network of the 1990s will be much broader than that of the 1980s. Different technology, a full three-tier computing environment, and the ever-expanding involvement of the end user in the decision and execution phases all suggest that the data management process must be much broader and balanced between planning and application.

The next two exhibits (Exhibits II-5 and II-6) provide a framework for the required data management process. The framework covers all three tiers of computing and reaches from the corporate level to the workstation and many personal systems. If there is data transfer or data access by a workstation system to another level, there must be data management process participation.

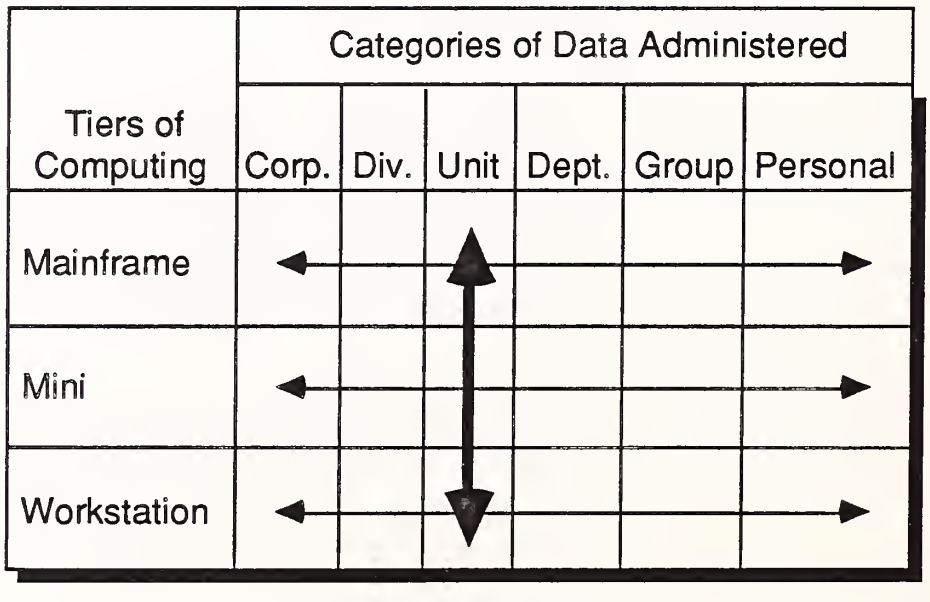
EXHIBIT II-5

DATA MANAGEMENT PROCESS FOR THE 1990s

Tier	Description	Functions
1	Infrastructure	Information Architecture Data Network Modeling Technology Selection
2	Definition	Definition Standards Definition Review Coding Schemes
3	Execution	Data Element Definition Design Execution DBMS Installation & Support

EXHIBIT II-6

DATA MANAGEMENT BREADTH OF RESPONSIBILITY



The individual who directs this process must be different than today's technical data administrator. Just as other functions within information systems must be better students of the business of the organization, so must the data manager. The most important element will be the data architecture and overall direction, not the individual designs. This requires a broad understanding of the role of data management in company strategy and operations.

G

Recommendations

INPUT's recommendation is to begin immediately a reassessment and expanded orientation for data administration. A few organizations have begun this process, but few have advanced very far.

Exhibit II-7 lists a series of objectives for 1989 that are designed to launch the move towards this expanded orientation. If successfully achieved, the first steps will be completed.

Exhibit II-8 takes the next step and sets a broader set of objectives for the early years of the 1990s. The message is clear: data management is a process that is required to support the highly integrated information network of the 1990s, and it is information system's task to put it in place.

EXHIBIT II-7

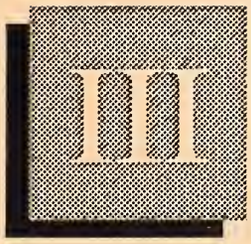
DATA MANAGEMENT OBJECTIVES FOR 1989

- Audit the Data Administration
- Define a Data Management Charter
- Select a SQL DBMS for PC Use
- Re-emphasize the Data Dictionary
- Introduce a Generalist into the Data Administration Function
- Audit the Use of Minicomputer DBMS Systems

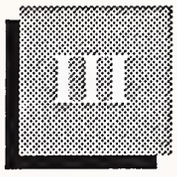
EXHIBIT II-8

DATA MANAGEMENT OBJECTIVES BEYOND 1989

- Broaden the Data Management Process to All Levels of the Information Network
- Launch a User Training Program in All Aspects of Data Base Use
- Develop a Data Architecture
- Market the Data Management Process at All Levels of the Organization
- Begin to Segment the Data Management Process for the Eventual Shift of Some Tasks to Unit and End-User Information Systems Groups
- Explore the Impacts of CASE on the Data Management and Administration Processes
- Support Experimentation with Distributed DBMS.



Data Administration: Current Environment



Data Administration: Current Environment

A Historical Perspective

The data administration role was born in the early 1970s with the first use of data base management systems, in particular, IBM's DL/1 and IMS. These new data management technologies provided information systems with a major advancement in the storage and use of data within application systems. However, their use required special technical skills and controls to assure that the application used the DBMS properly.

Prior to DBMS technology, the data administration process was simply performed by the systems analyst as an application was developed. Now with DBMS, it became necessary to have a specialist who understood the technology and could work with multiple analysts who were all building applications that would access a given data base.

As with many advancements in information technology, the advent of DBMS brought a new technical challenge that was addressed by developing a technology specialist. The first DBAs were, of necessity, very skillful application or systems programmers. The data management function started with "data administration" and was thus staffed by a technical person, not by one that understood the business or the applications or how the resulting data was to be used by the business.

By the early 1980s, most organizations had installed a DBMS and were managing a data administration function. Throughout this period and until very late in the 1980s, most information systems organizations were using a single DBMS and viewed the function as a technical one.

During the 1980s there were varied efforts to implement control mechanisms, usually based on a data dictionary system that was designed to give administrative control to the data definition process and to provide a help tool for the DBA. Most early efforts with data dictionaries were of modest success and the technology was at best satisfactory.

By the mid-1980s a number of events had occurred that began to cloud the job of data administration and to raise higher level issues; the genesis of data management was starting, but few recognized it. Most significant among these events were the following:

- The majority of the applications in many organizations were now DBMS-based, and the interaction between these applications gave rise to the corporate data base concept. In a file management environment the data was tied to the application and "owned" by the department that was served by the particular application. In a data base environment ownership of the data became diffused. The data was organized for the benefit of the DBMS technology and ease of processing, not to support the organization. The data base was information system's, not the user's.

- The information network of most organizations was becoming distributed with the use of minicomputers. To support this distribution, elaborate file transfer systems were developed, and a new era of data redundancy developed. Information systems considered the central data bases as their property and carefully guarded their use. The user, however, began to depend on the distributed data on the minicomputers, and, of course, PCs. The information network and its data foundation had become distributed without a process to control it.

- The DBMS technology began to undergo a fundamental change. The long-sought relational data model became available and by 1987 was in early use by many organizations. The technological basis for the data administration process began a major change that will be underway well into the 1990s.

- The end users began to develop production applications and make extensive use of the corporate data bases through fourth-generation languages. And the end users found the relational DBMS technology something that they could understand, at least to a modest degree, as they become more skilled users of computers.

As one stops to measure the status of the data management function, one finds it on the edge of major change. This chapter and the next two chapters will confirm this.

B

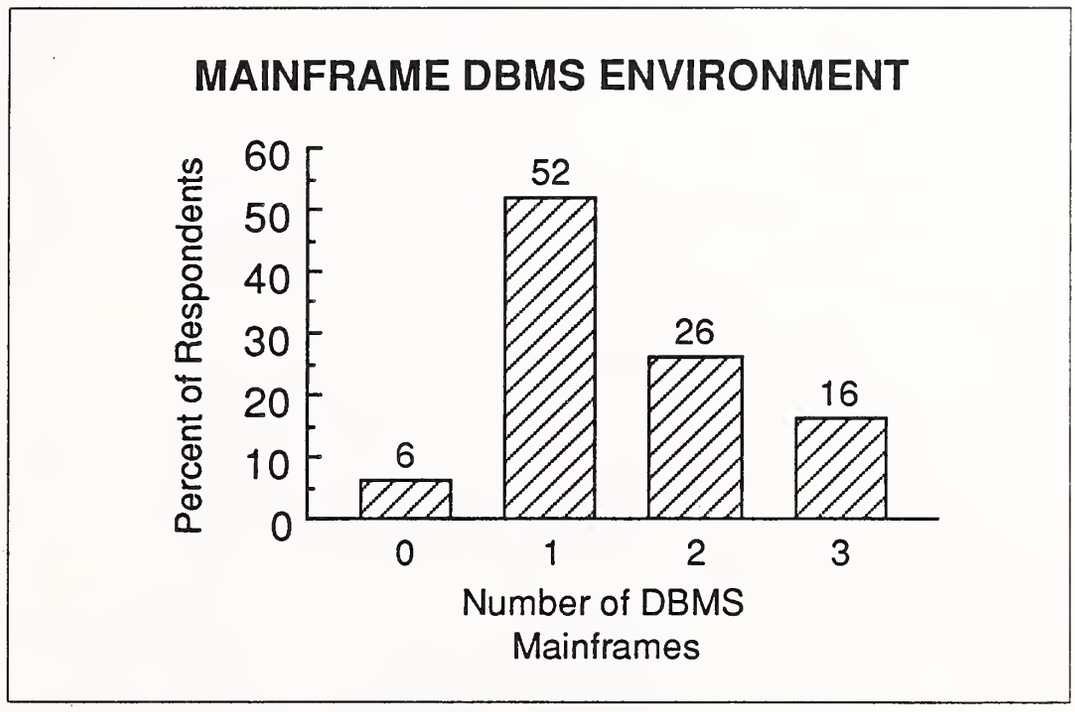
Changing Environment

Almost every information systems organization is in the process of significant change relative to its data base management systems environment. From environments consisting of a single mainframe DBMS, most organizations are now dealing with multiple DBMSs on both mainframes and minicomputers, and to a growing degree, on personal computers, as the PC becomes the common workstation in the network.

1. Mainframe DBMS

Exhibit III-1 shows the growing tendency to support more than one mainframe data base system. Forty-two percent (42%) of the respondents indicated they were using more than one mainframe DBMS, and 16% indicated that they had three mainframe DBMSs. Only 6% indicated that they had not yet installed a DBMS.

EXHIBIT III-1



The technical challenge of learning and supporting two or three mainframe DBMSs places significant strain on the data administration function. Also, the task of supporting data transfer between them is extensive.

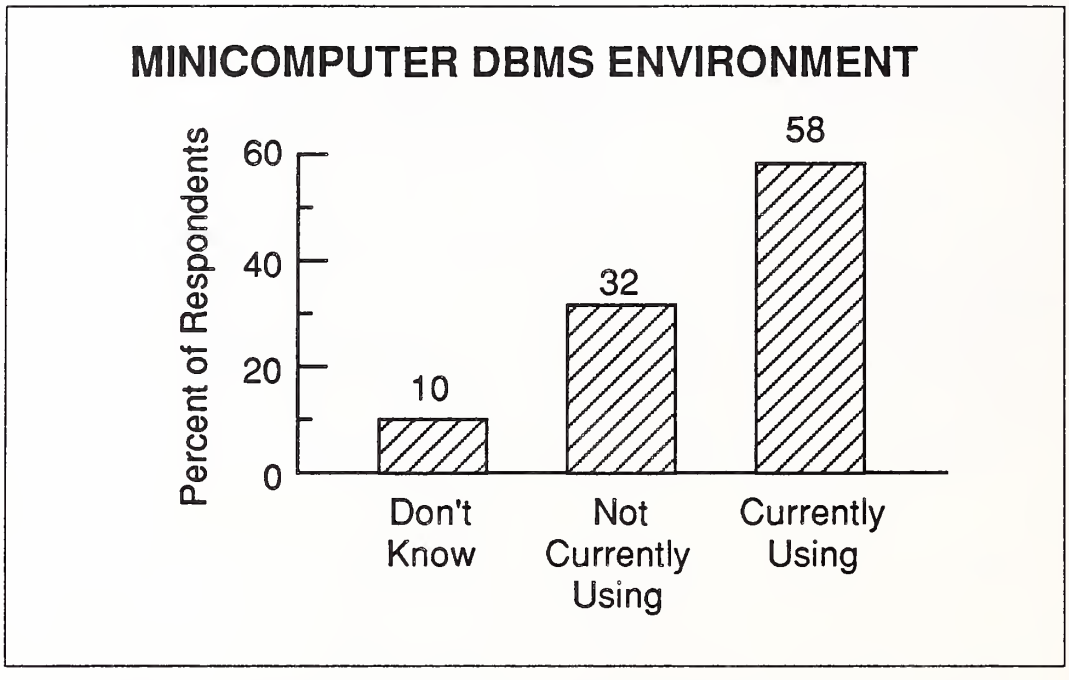
INPUT also learned that only 28% of those with more than a single mainframe DBMS had a relational DBMS as the second or third DBMS. Since there is a rapid move towards RDBMS technology, this means many information systems organizations will be adding yet another DBMS to their mainframe computing activity.

2. Minicomputer DBMS

Exhibit III-2 describes the state of DBMS use on minicomputers and at the mid-tier of a three-tier information network.

The fact that over half of the organizations are using DBMS technology at the middle level is not surprising. The success of Digital (with R/db), Oracle, and Relational Technology confirms the rate at which file-based systems are being replaced by DBMSs on minicomputers.

EXHIBIT III-2



The finding that one data base manager in ten did not know if there were minicomputer DBMSs in use raises a flag. In these organizations, the information systems organization is not involved in the technology being deployed outside the corporate mainframe environment.

The use of RDBMS on minicomputers exceeds that of mainframes. Twenty-five percent (25%) indicated that they were using RDBMS, with 43% of the DBMSs installed being relational. From this point it can be predicted that RDBMS will be the dominant DBMS installed at the minicomputer level of the information network.

3. Personal Computer DBMS

It is not surprising that essentially all respondents indicated DBMS technology was in use at the PC level. Dominated by dBase III from Ashton-Tate, the current environment of PC data base activity is primarily for personal productivity use and is not relational.

However, the direction is beginning to shift. Both Oracle and Relational Technology have ported their RDBMS technology to the PC, and OS/2 Extended Edition includes a SQL-based DBMS. The move towards RDBMS at the PC level is underway and will quicken as the desire to transfer data across the tiers of the information network, in a common format, increases. SQL and RDBMS will be the foundation for such transfer.

4. Considering New DBMSs

A further indication of the amount of change taking place in the DBMS environment is the number of information systems organizations consid-

ering new DBMS systems. A full 30% have new DBMSs under consideration.

- All of the systems under consideration are relational DBMS.
- The most often mentioned were DB2, Oracle, and Ingres, in that order.

Truly, to a degree far greater than ever before, the technology used to manage the data foundation of the information network is undergoing significant change.

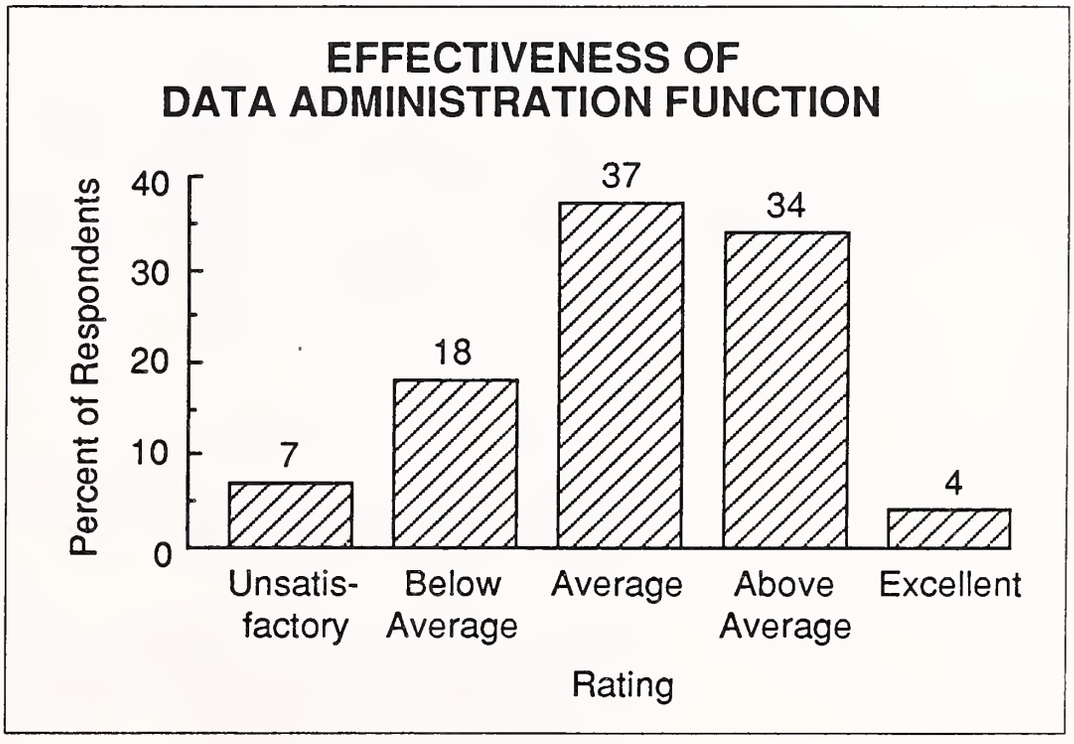
C

Effectiveness of Data Administration

Once you accept the premise that the data management environment is at a point of transition, it becomes important to evaluate its readiness to move into a second era.

An early test is to assess the current effectiveness. Exhibit III-3 reports the effectiveness of the data administration function as measured by the actual manager of the function.

EXHIBIT III-3



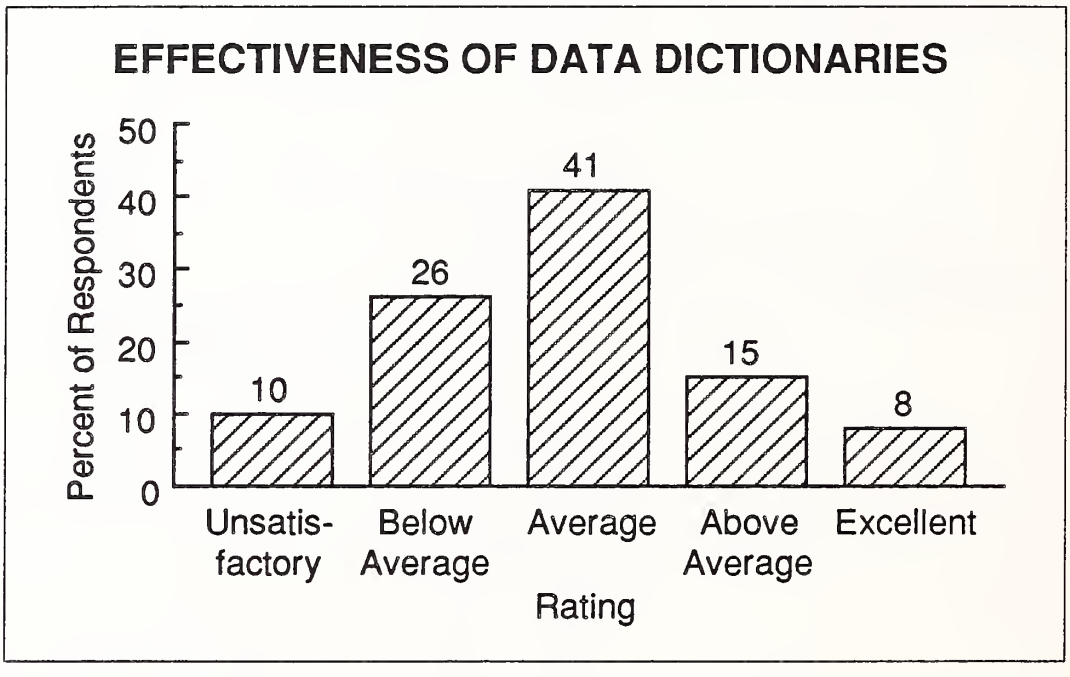
Only 38% of the 100 managers of data management felt they did better than an average job and 25% felt the effectiveness of their function was below average.

These findings indicate a lack of a solid base from which to expand into new responsibilities and new DBMS technologies.

One of the weaknesses of the data management function has been the lack of support technologies that help with the administrative and control processes. The long-standing goal of a truly implemented data dictionary has not been achieved by very many information systems organizations. In addition, the concept has not been strongly backed by the DBMS vendors, particularly IBM.

Exhibit III-4 provides a measure of the effectiveness of the data dictionary concept. INPUT found that 79% percent of the organizations were using data dictionaries and another 10% were planning to install one. However, only 23% felt their use was above average, and a full 36% rated their use as below average or unsatisfactory.

EXHIBIT III-4



Further, as Exhibit III-5 shows, slightly less than half of those using a data dictionary indicated that they had 100% of the data elements administered through the dictionary.

As the data infrastructure and the use of DBMS technology spreads to all three tiers of the information network, the lack of an effectively implemented data dictionary will make the broadening data management task much more difficult to perform.

D

Key Issues

Exhibit III-6 lists the key issues reported by the data management managers interviewed by INPUT.

Most commonly mentioned was a need for a more clear strategy and direction for the data management function. The criticality of this issues is reflected by it being mentioned twice as often as the second issues, integrity and security, and three or four times as often as the other issues.

EXHIBIT III-5

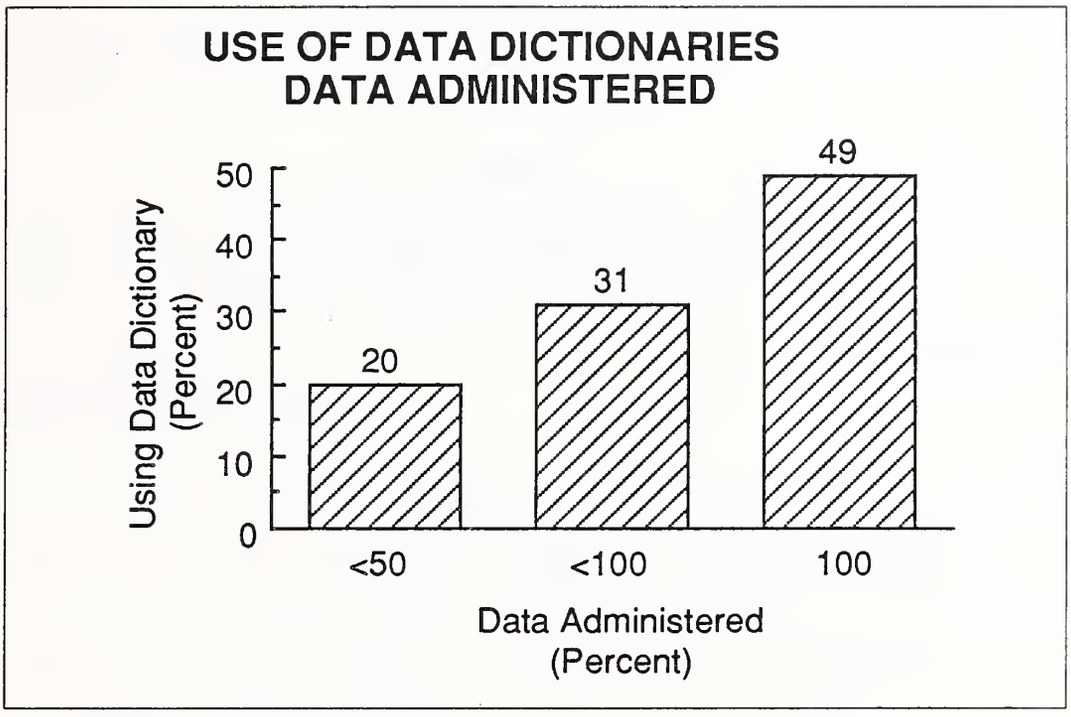
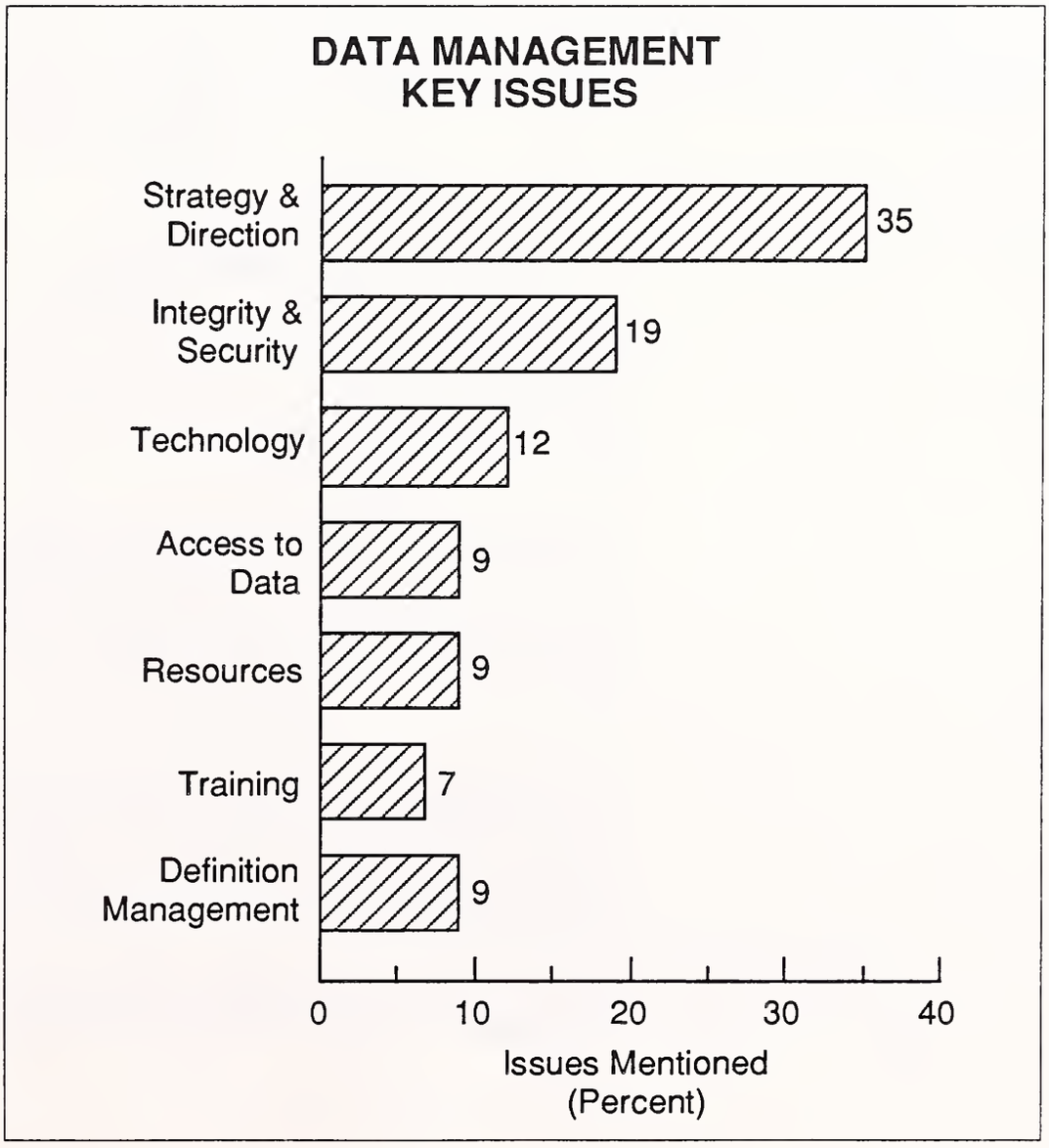


EXHIBIT III-6

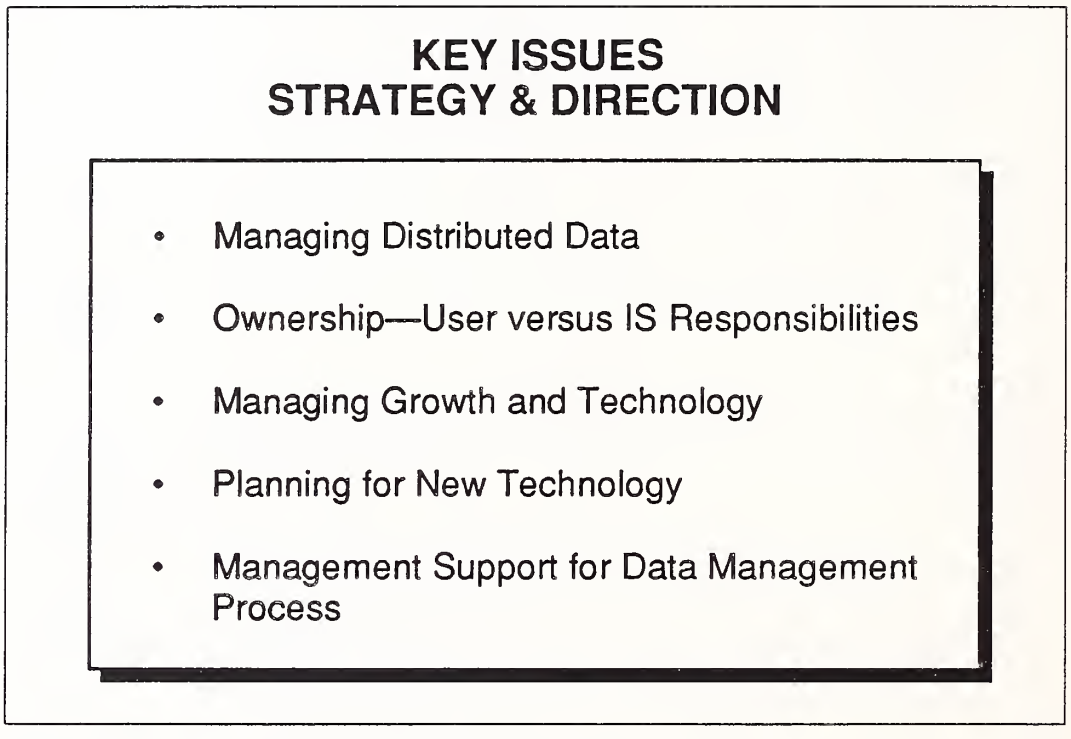


The second issue, integrity and security, is an indication of the rising concern for control and discipline brought on by the exploding file transfer activity across the tiers of computing.

1. Strategy and Direction

The five elements underlying the strategy and direction issue are listed in Exhibit III-7. Each is significant on its own.

EXHIBIT III-7



Managing Distributed Data—The data manager recognizes that distributed data is an actuality yet feels a need to support its proper use and control. At the same time the policies and control technologies are not in place to accomplish this task.

Ownership—Data base technology has caused the concept of data ownership to become unsettled. Information systems seems to own the data because they administer the data bases and strive for data commonality across the information network. The user feels a sense of ownership, but does not know how to exercise the ownership.

Managing Growth and Technology—The transition from a single DBMS on the mainframe to multiple DBMSs at all three tiers of the information network is recognized as an immense change. Yet the transition has most commonly occurred by chance, not by plan, and the data management function has not been allowed to plan the transition.

Planning for New Technology—The transition to the first DBMS was often a slow one, based on the development of new applications. Now

companies are leaping to multiple DBMS environments, at both the mainframe and minicomputer levels, without a long range data architecture.

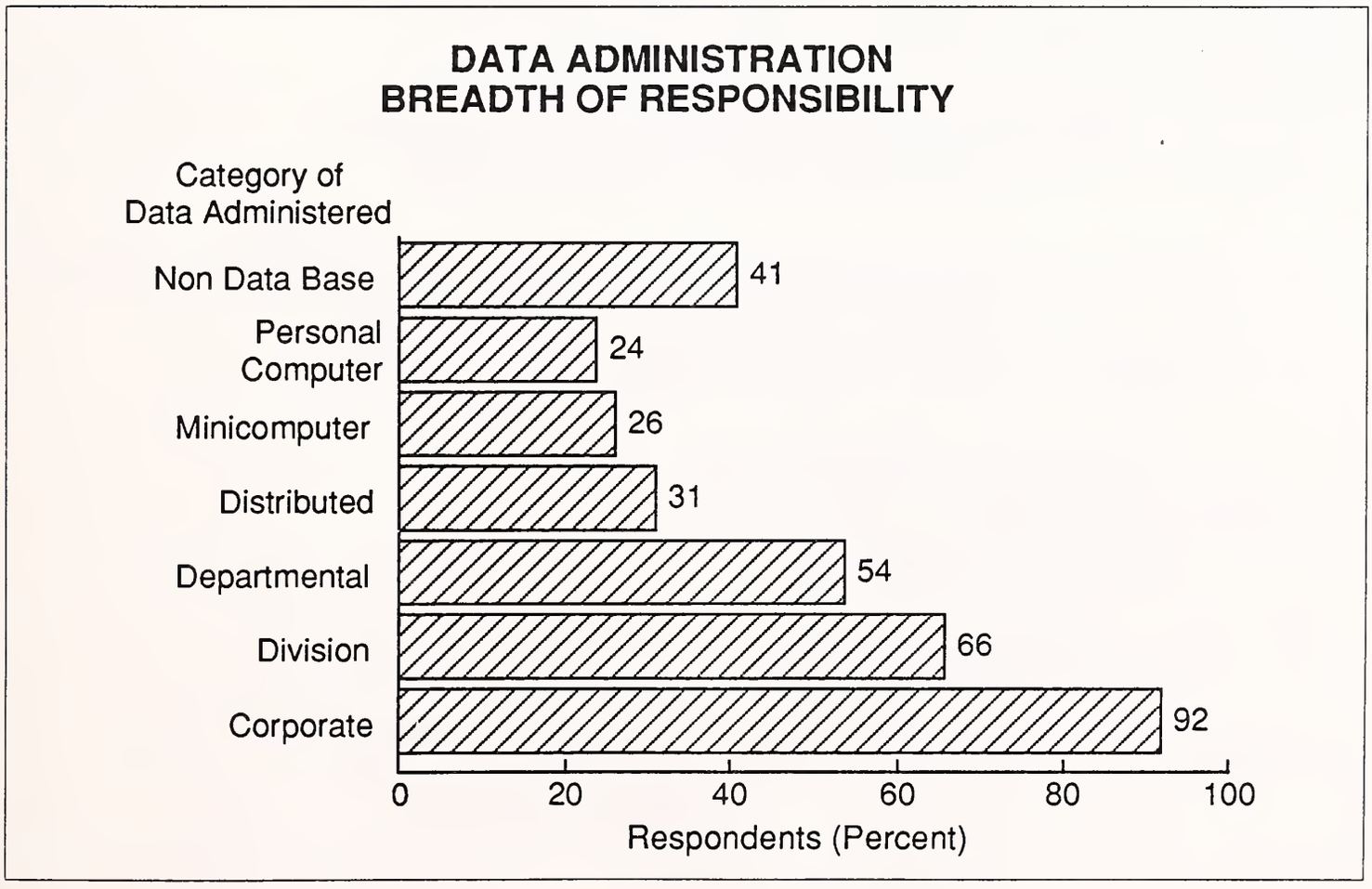
Management Support for the Data Management Process—Data administration remains a technical process in the minds of many information systems managers and is not understood by user management. As a result, there is little general support for upgrading the function to a broader data management concept.

2. Integrity and Security

The fundamental elements of the integrity and security issue are found in the growth of distributed and personal computing and the flow of data across a multi-tiered computing network. Data administration as a process works quite well at the mainframe or central level, in particular if a single DBMS is in use. But as the computing resource spreads out, the traditional, and often simplistic, control processes begin to break down.

Exhibit III-8 helps describe the basis for this issue. INPUT asked the data management managers if their function involved administration of data at various levels of computing. The results reflect both positive and negative findings.

EXHIBIT III-8



The 92% response to corporate data confirms that the objective of interviewing the central data management function was achieved.

The 66% response to division data suggests that most of the division computing is on a mainframe, probably run by the central organization with data administration being provided centrally for cost or historical control reasons.

The responses on distributed, minicomputer and personal computer data indicate a relatively low level of involvement by the central data administration organization. Certainly a response that one in four are involved to some degree suggests some effort to influence the data administration process at all levels of the network, but it does not suggest that a true network-wide data management process is in effect to any significant degree.

3. Resources

Data administration remains a staff/support function within most information systems organizations. As such, its resources have been and remain constrained to some degree.

Exhibits III-9 and III-10 indicate the size and growth of the data administration function compared to the other major functions of information systems.

EXHIBIT III-9

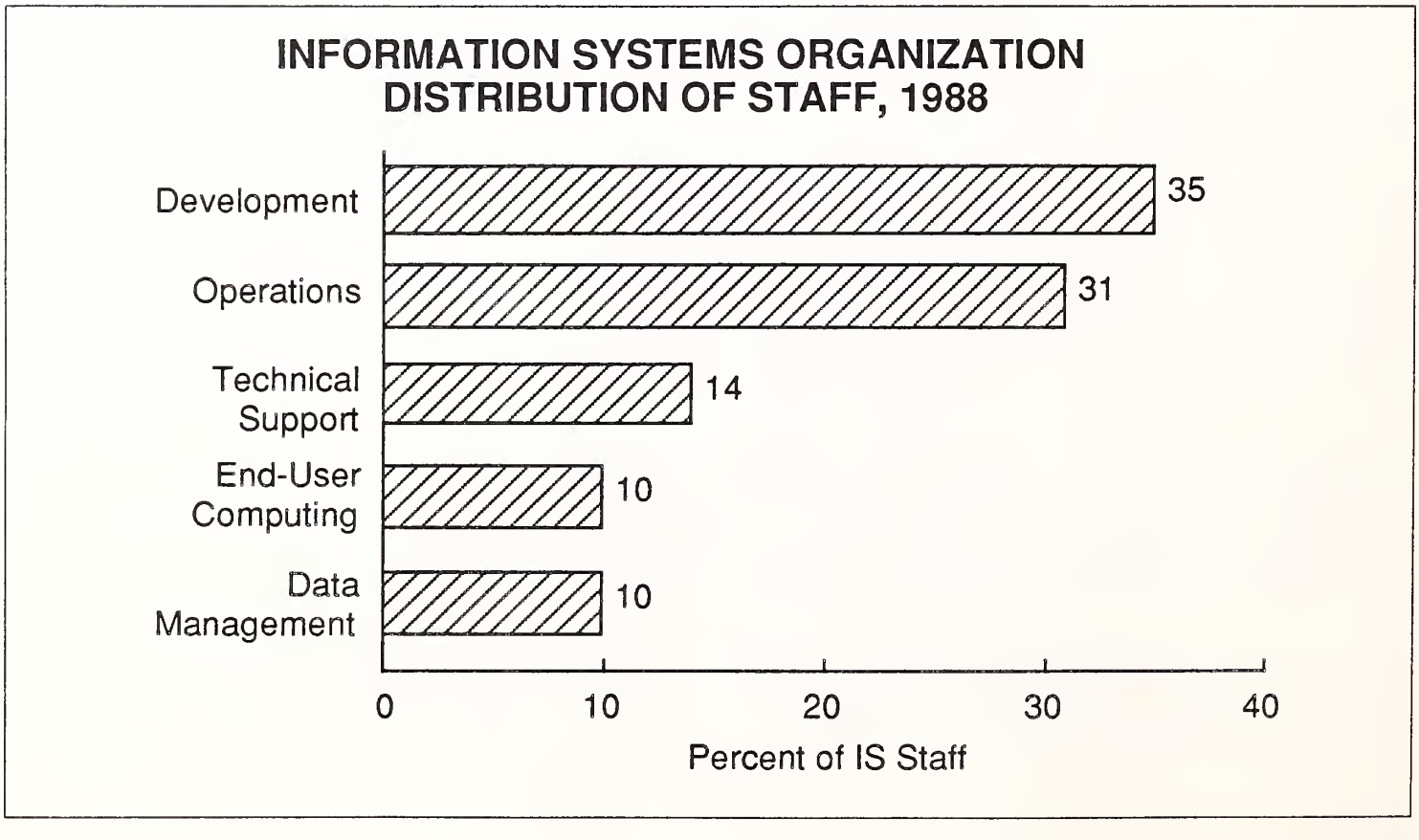
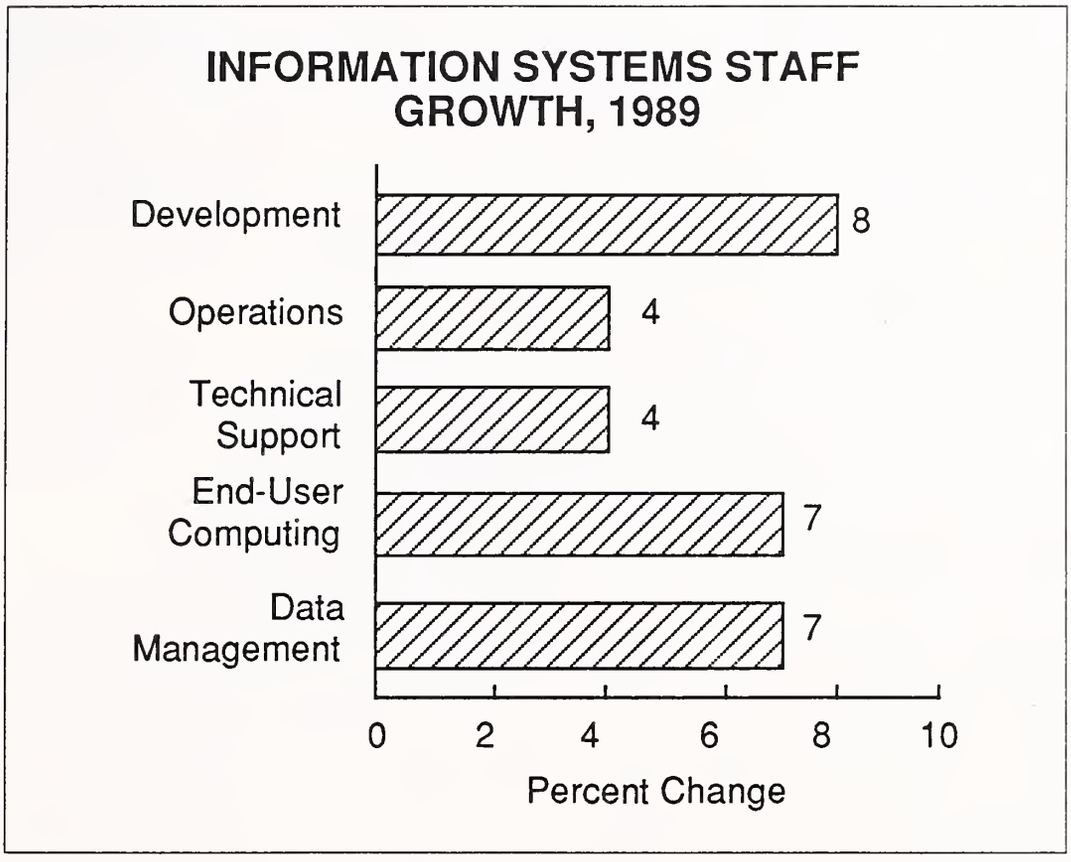


EXHIBIT III-10



On average, data administration represents 10% of information systems. In 1989 the data administration function will grow by 7% or at the same rate as development and end user computing. Given the challenge that lies ahead and the reported concern about effectiveness, it may take a more substantial increase in resources to meet the long-term objectives as defined in Chapter VI. Information systems management needs to consider the changing role of data administration and increased resources.

E

Changing Role

There is modest indication that the role of data administration is changing. Exhibit III-11 reports that 27% of those interviewed indicated that there had been a change in function in the past year, and another 15% indicated there had been a change in technology with the implementation of a relational DBMS.

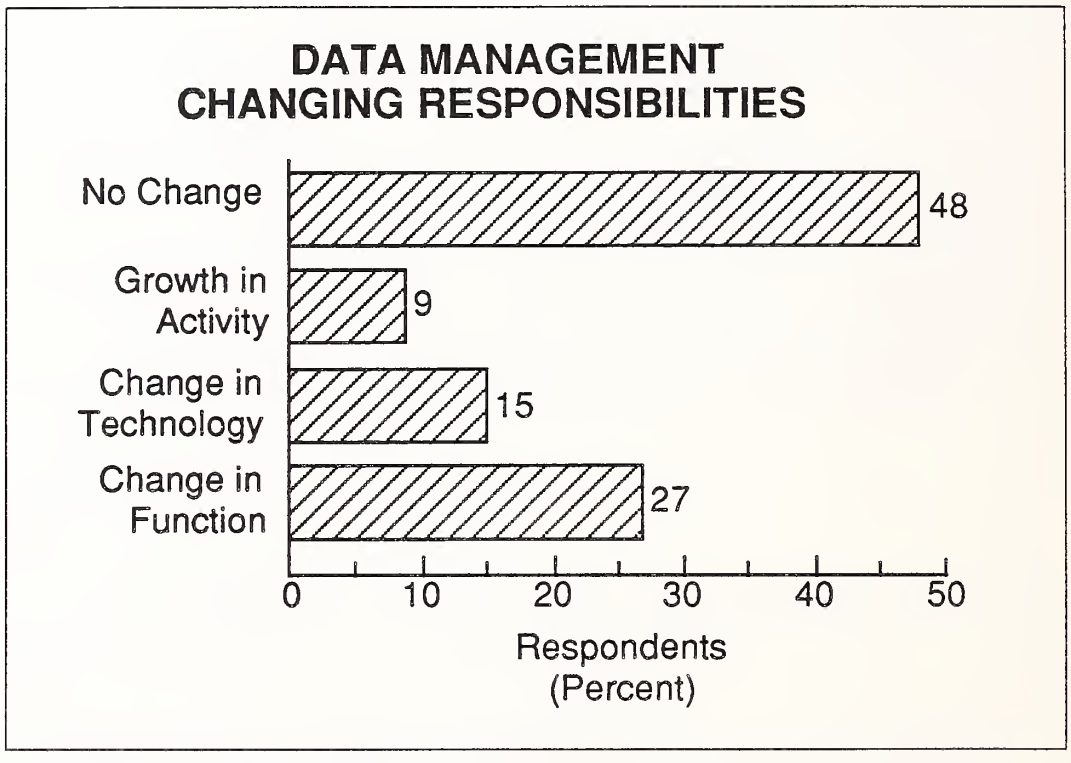
For the most part these changes included the administration of data outside the central data base environment, including departmental minicomputers.

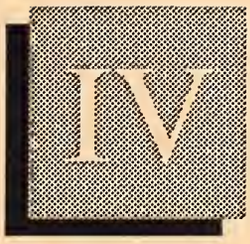
In a few instances there was a move to a decentralized data administration structure.

There were also mentions of the addition of resources that were permitting an expansion and strengthening of data administration services.

However, in general the current management of data administration does not see its role expanding a great deal and is struggling just keep up with the current short-term demands.

EXHIBIT III-10





Impacts of Relational Data Base Technology

IV

Impacts of Relational Data Base Technology

The Introduction noted that one of the driving forces of the need for an expanded role for data management is the impact of relational data base technology. The relational model is bringing a number of changes, mostly for the best, to the use of data base technology.

This chapter looks at the state of RDBMS use and the impacts of the relational model on application design, the data administration process, and the involvement of the end user in computing.

The relational data base model is many years old but has now come of age and is driving major changes.

A Status of Relational DBMS Use

1. Trend Towards Increasing Use of RDBMS

As Exhibit IV-1 indicates, the use of RDBMS systems has become commonplace. Slightly over 60% of the information systems managers indicated they were actively developing RDBMS-based applications, and a somewhat surprising 37% indicated that end users were actively using RDBMS technology.

It seems that just in the past 18 months, the move to RDBMS has taken hold and is quickly becoming the dominant DBMS technology for new applications.

The general level of use indicates that information systems is quickly seeing benefits in the use of relational versus traditional data base technology.

The level of use by the end user suggests that the claims about the ease of use of RDBMS are proving true.

EXHIBIT IV-1

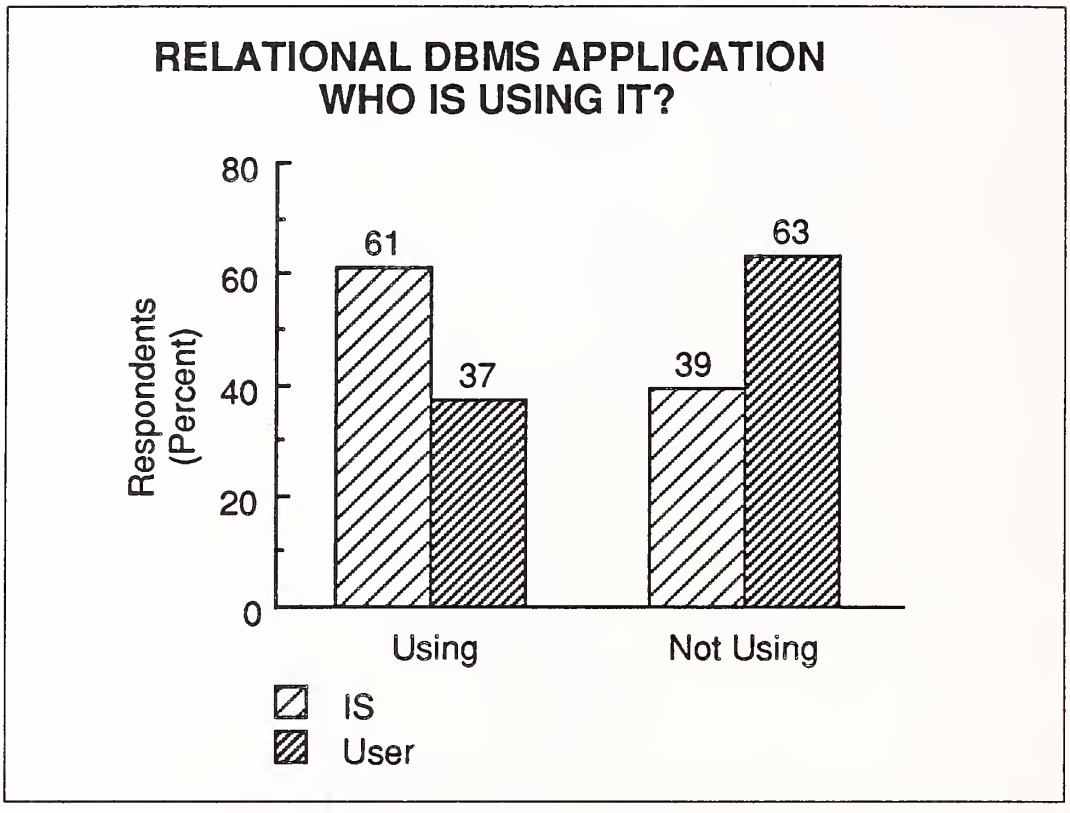
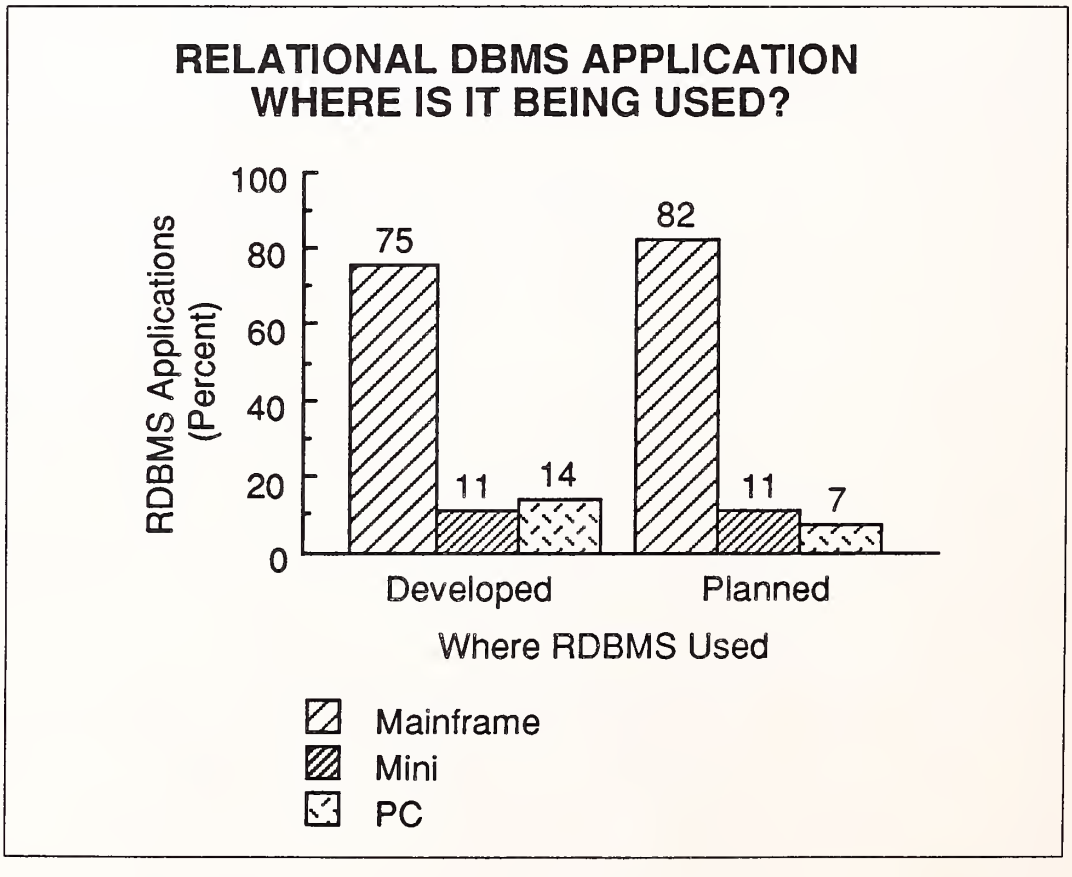


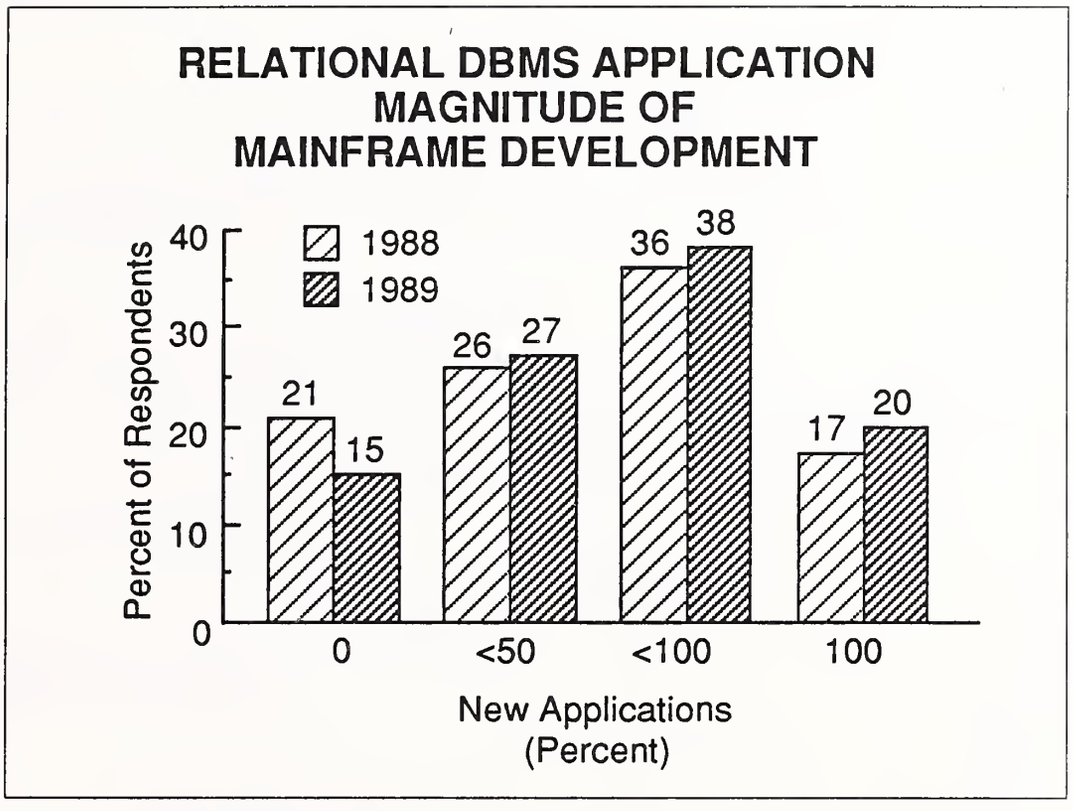
Exhibit IV-2 indicates the response to a question about where RDBMS was being used. The dominance of the mainframe use is not surprising, given that the question was asked of the central information systems organization. However, there is indication of use on all tiers of the information network.

EXHIBIT IV-2



Finally of interest is the magnitude of mainframe use as a percent of new development. A careful review of Exhibit IV-3 indicates some surprisingly strong commitments to mainframe use of RDBMS.

EXHIBIT IV-3



One organization in five is now developing 100% of its new mainframe applications in RDBMS technology. They have decided that no new traditional DBMS mainframe applications will be developed.

Over half of the organizations are developing at least 50% of their new applications with RDBMS.

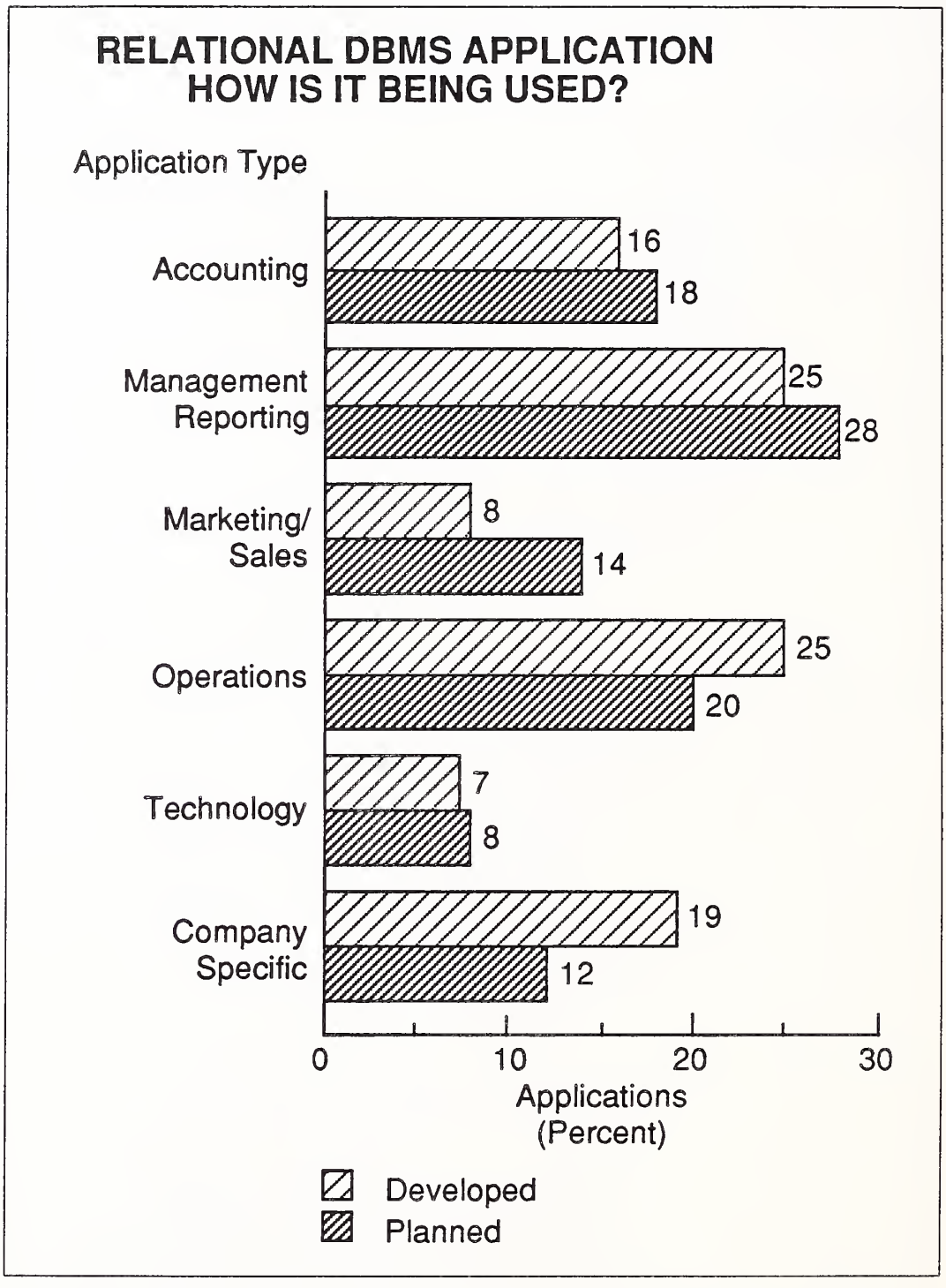
Only 21%, plan no development using a mainframe RDBMS. In 1989 the level with no such plans drops to 15%.

These findings are the strongest indication that RDBMS is quickly becoming accepted and is the DBMS of choice for future development. The criticisms and concerns about RDBMS performance and data security that were still being strongly expressed in 1987 seemed to have passed, and information systems is accepting RDBMS as a preferred and reasonably proven technology.

2. How It Is Being Used

The most common uses of RDBMS technology are in management reporting and operational systems, as indicated in Exhibit IV-4.

EXHIBIT IV-4



The management reporting category is not surprising given the orientation of the relational model and its ease of use for data extraction and analysis.

- One of the first uses of relational technology by software development companies has been in the executive information or support systems area, where the ability to easily specify ever-changing views of the data is fundamental to the application.

- Another commonly mentioned management application was human resources.

The use in operational systems, however is surprising. In spite of improvements in DB2 Release 2 and stated performance levels by Oracle and Ingres, the transaction performance of RDBMS technology remains a concern or, at least, an unproven capability.

Operational applications mentioned included agency tracking, claim processing, and numerous manufacturing systems.

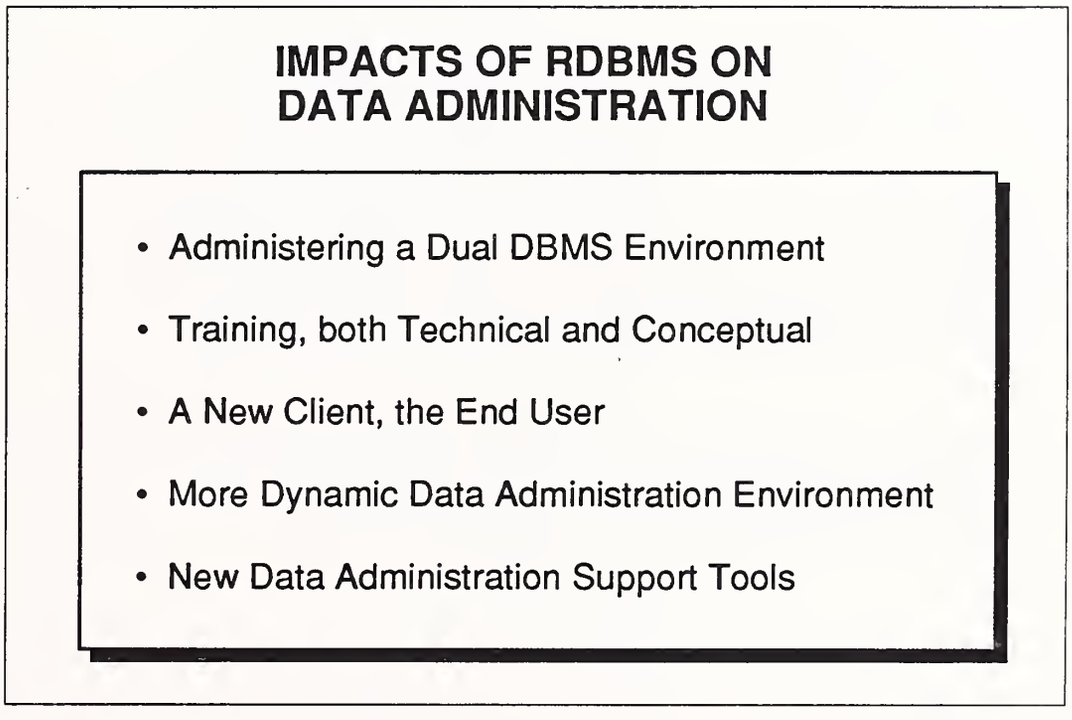
While the dominant environment was, of course, mainframes, numerous applications were mentioned using minicomputer platforms.

B

Impacts of RDBMS on Data Administration

There are numerous impacts on the data administration process and organization from the introduction of RDBMS technology. While some are obvious, others may not be so readily apparent. Exhibit IV-5 lists some of the most important impacts, which are discussed below.

EXHIBIT IV-5



1. Dual DBMS Environment

Although IBM, with its IMS/DL1 and DB2 data base strategy, has indicated that a dual DBMS environment is a necessity at the mainframe level, few believe administering such an environment will be easy. From the challenge of understanding two different technologies to the task of controlling the data transfer and translation between the technologies, the data administration task simply requires added control and care.

It is interesting to note again the percentage of the information systems organizations that are moving very quickly to do a majority, if not all, of their new development in the relational DBMS. Knowing that much of

this is IBM mainframe-based indicates that the dual environment is not well-accepted and will speed the move to a full RDBMS program.

2. Training

Training, in particular technical training, remains a way of life for information systems professionals, including DBAs. However, DBAs have spent a number of years fine tuning their profession. They have often escaped the 4GL and other technology changes that impacted applications development and the distribution of processing and brought headaches to the data center manager.

Now they will have to become bilingual, start the learning process over again, and learn to do things differently. RDBMS applications are not designed the way traditional applications have been designed. New concepts as well as new technology must be learned.

3. New Client, the End User

One of the goals of RDBMS use is increased access to data and information by management. The simpler-to-use RDBMS is providing a new impetus to the end-user computing revolution. For data management the end user is a new client. In the past data management served only the applications development profession—technical people. Now it will be interfacing with the end user, whose priorities are significantly different.

- Response will be the key measurement.
- Technical excuses will be neither accepted nor understood.
- Flexibility will be the underlying requirement.

4. Dynamic Environment

The early uses of RDBMS are often in application areas that have not been successfully served by DBMS technology, in particular, the management reporting area. The non-achieved "management information system" objective of the late 1970s and early 1980s is infamous. Few if any such systems were built because the technology would not support the objectives. Today they can be met because of RDBMS technology.

Management reporting systems, sales and marketing analysis systems, and many other early RDBMS-based applications will be used by users who want to ask ever-changing questions. The answers will require ever-changing "views" of the relational data base. Ease of change and simple two-dimensional table-like views of data relationships make RDBMS valuable. Taking advantage of this capability will require a flexible DBA who understands the reasons for the changes and accepts them as part of the data administration process.

And as we will discuss in Chapter V, the availability of distributed data base management systems will make the data modeling process a dynamic, almost continuous process. Today under the traditional technology, it is a seldom-repeated process once a data base is designed.

5. New Support Tools

Most data administration functions have survived to date without a full-function data dictionary or other administrative tools. Some are using data modeling technologies, but to support the traditional DBMS environment.

The dynamic nature of the RDBMS environment, the use of multiple DBMS systems, and the increased linkage of data networks and end user computing technologies all will require tighter administration. In addition, many of the newer RDBMS systems (Oracle, Sybase, Ingres) all include an integrated data dictionary.

New tools will be available to help and more importantly, will have to be used to meet the expanded and changed data administration responsibilities.

C

RDBMS and the End User

We have already reported that the end user is using RDBMS technology. Exhibit IV-1 indicated almost 40% of the organizations interviewed indicated that the end user was using RDBMS technology to some degree.

Exhibit IV-6 compares that use, on the three tiers of the computing network, with that of information systems. Not surprising there is a greater use at the PC level, yet the activity is reasonably high at the mainframe.

1. Mainframe Use

The end users' use of mainframe RDBMS capabilities can be tied to the management reporting systems activity. The user is using 4GL technology to access and extract data from a relational data base that has been established for that purpose. In many instances the user is moving the information to a PC for further processing.

Exhibit IV-7 shows the dominant use is in management reporting applications.

EXHIBIT IV-6

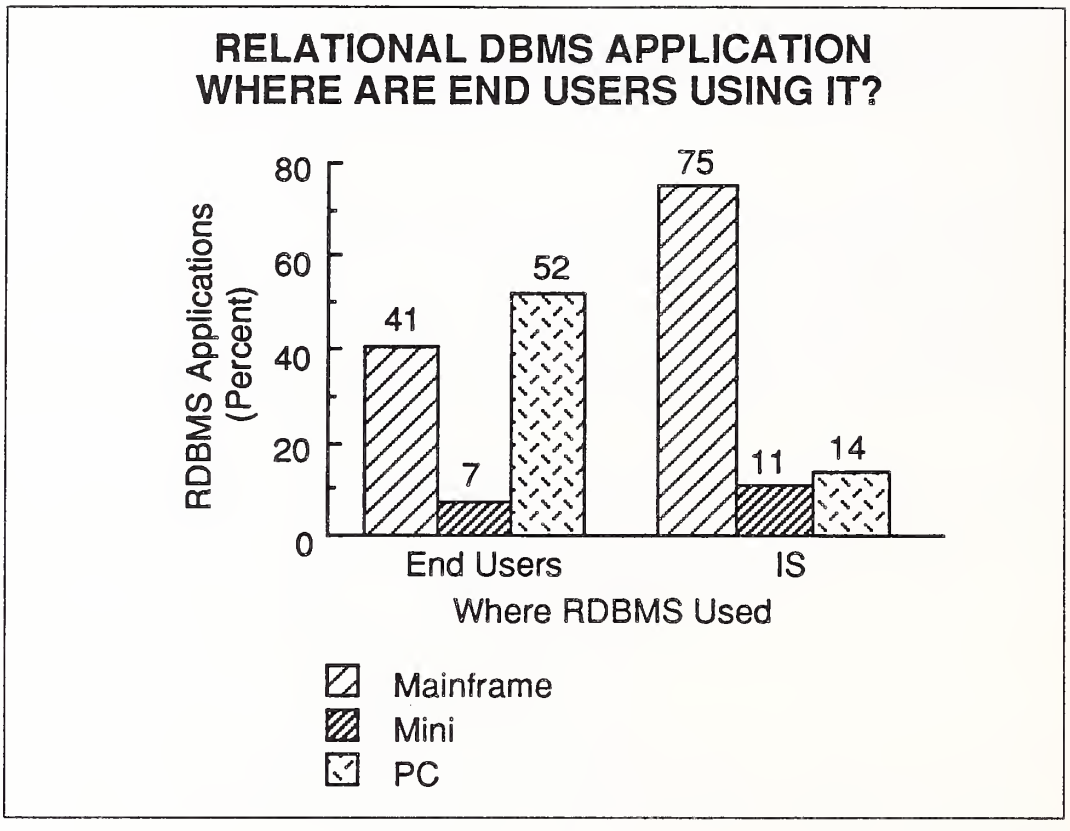
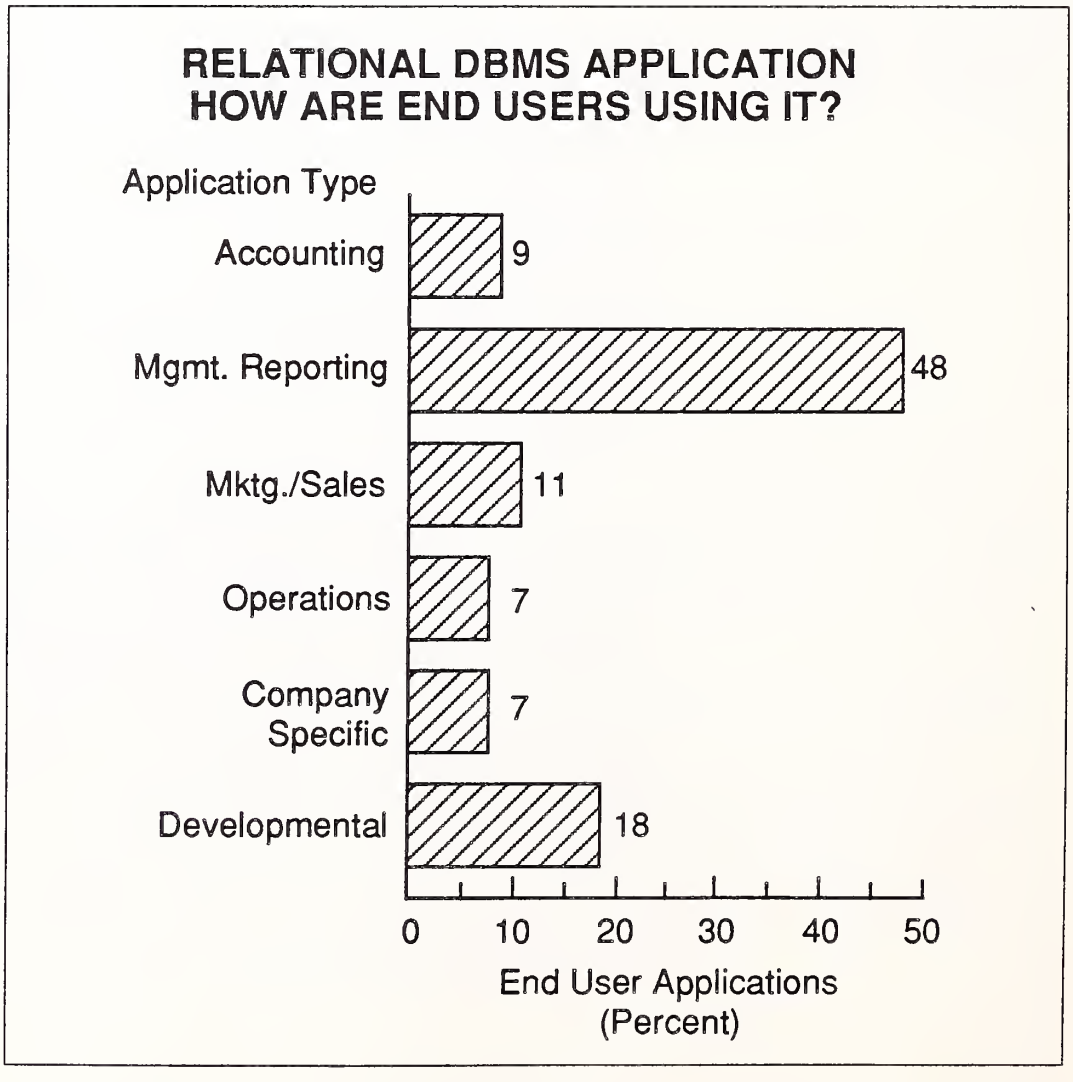


EXHIBIT IV-7



2. Minicomputer Use

A great deal of the early RDBMS sales activity by Oracle, Relational Technology, and Digital Equipment has been directed to the end-user community, often bypassing information systems. While the research indicates a relatively low use (7% of the activity), the growing availability of this technology, often with an integrated 4GL and other easy-to-use languages, suggests a major increase in end-user RDBMS use in the next few years at the minicomputer level.

Understanding and learning to use minicomputer RDBMS systems may be more important than mainframe technology in the immediate future for the data administrators. They still have a chance to gain influence at the mid-tier, but must move quickly. The vendors are selling the power of RDBMS to the user who does not fully understand it.

3. PC Use

The high level of apparent PC RDBMS use indicated in Exhibit IV-7 may be misleading. Too many individuals believe that dBase or similar PC DBMS systems are relational, but they are not. Examination of the applications that end users have built with such PC DBMS tools often reveals that they are really just sequential files. The concept of data base has not had true meaning.

The true PC-based RDBMS products such as Paradox, Oracle, and Ingres are beginning to penetrate the end user community and bring true relational capabilities. They are often compatible with their minicomputer versions, which means their use by the end user will grow at both tiers.

4. Implications

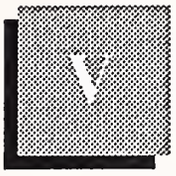
There are numerous implications for data management and information systems, in general, from the use of RDBMS technology by the end user. These are the three most significant.

- It is apparent that the end user can understand, at least to a modest degree, data base concepts through the relational model. After all, it is only a series of tables. As we have learned, a little knowledge can be dangerous and suggests the need for training of a different kind: concepts, as well as skills.

- End users are, and for the next few years will remain, more comfortable with their PCs and departmental minicomputers; thus, it is RDBMS technology that they will learn—either with the help of the data administration function and the information center or without it. Data administration must understand this RDBMS technology as well.

- At least in the near term, the end user will learn only that part of DBMS technology required to get the immediate job accomplished, not the aspects required to protect systems integrity and longevity. Data administration and information systems must move to provide a supportive role.

Impacts of Other Data Base Technologies



Impacts of Other Data Base Technologies

The data administration function is not only going to have to deal with two or three DBMS systems and the relational data model, but it is also going to have to be prepared to utilize distributed data base technology, manage a data base technology at the workstation, and support a revolution in the application development process being caused by the introduction of computer-assisted systems engineering (CASE) technology.

The relational model is just now becoming accepted, and more data base technology is on the way. This chapter discusses these additional changes in the tools and technologies that will impact the data administration process.

A Distributed Data Base Technology

Simply defined, distributed data base technology goes one very large step beyond relational technology. Using the relational model (in the majority of the products), a distributed data base management system (DDBMS) permits a single physical data base to be spread across more than one computer or platform.

Exhibit V-1, from INPUT's report *Distributed Data Base Management—An Early Look*, provides a graphical example of an application that uses DDBMS technology and that includes replicated (redundant) data. The distributed portion of the DBMS provides the technology to track data relationships across the platforms on which the data base resides, to permit and maintain redundant data where required for processing efficiency, and to assure a transaction that updates data stored on more than one platform does so on all affected platforms, or no platforms, thus maintaining data integrity.

EXHIBIT V-1

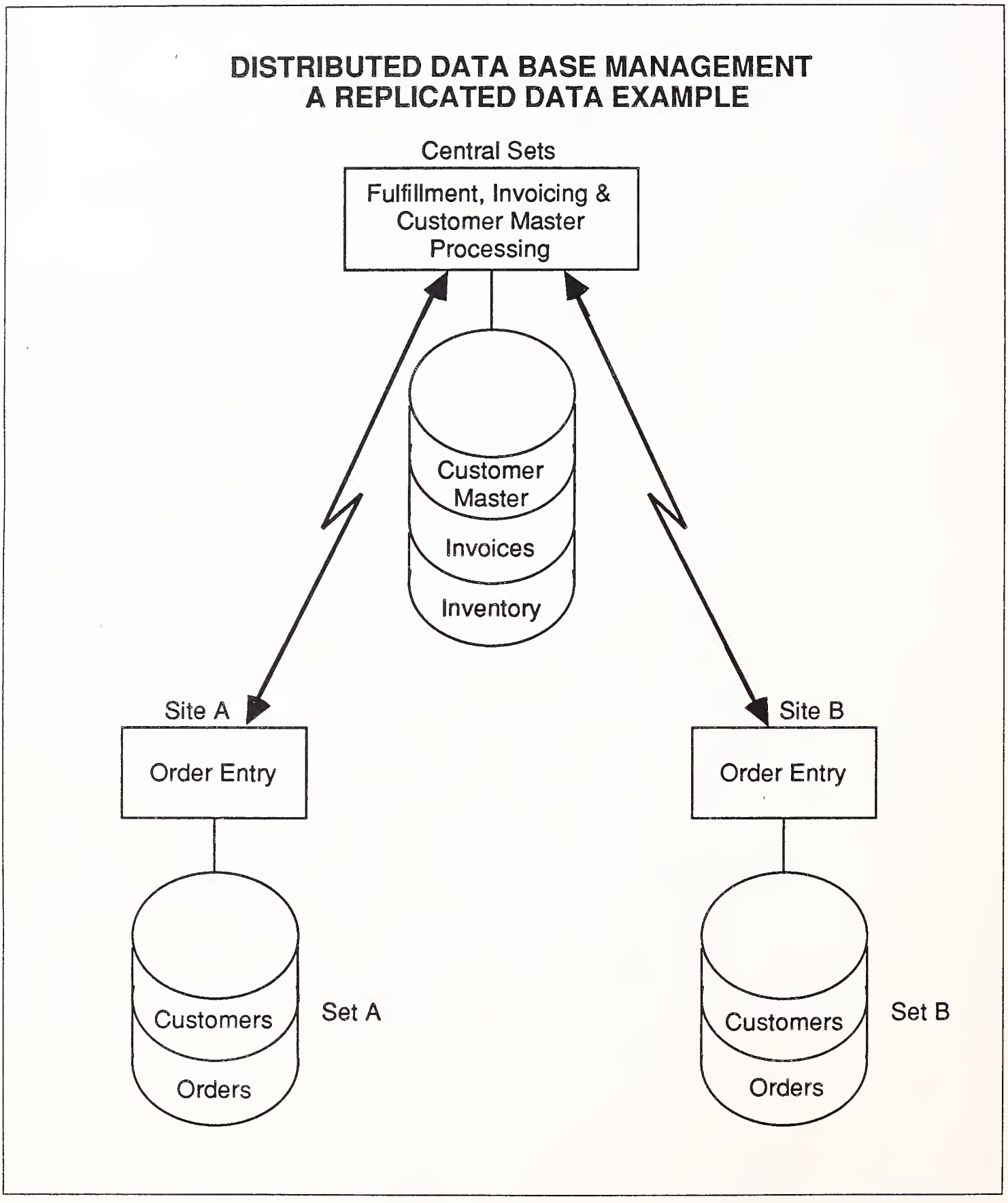
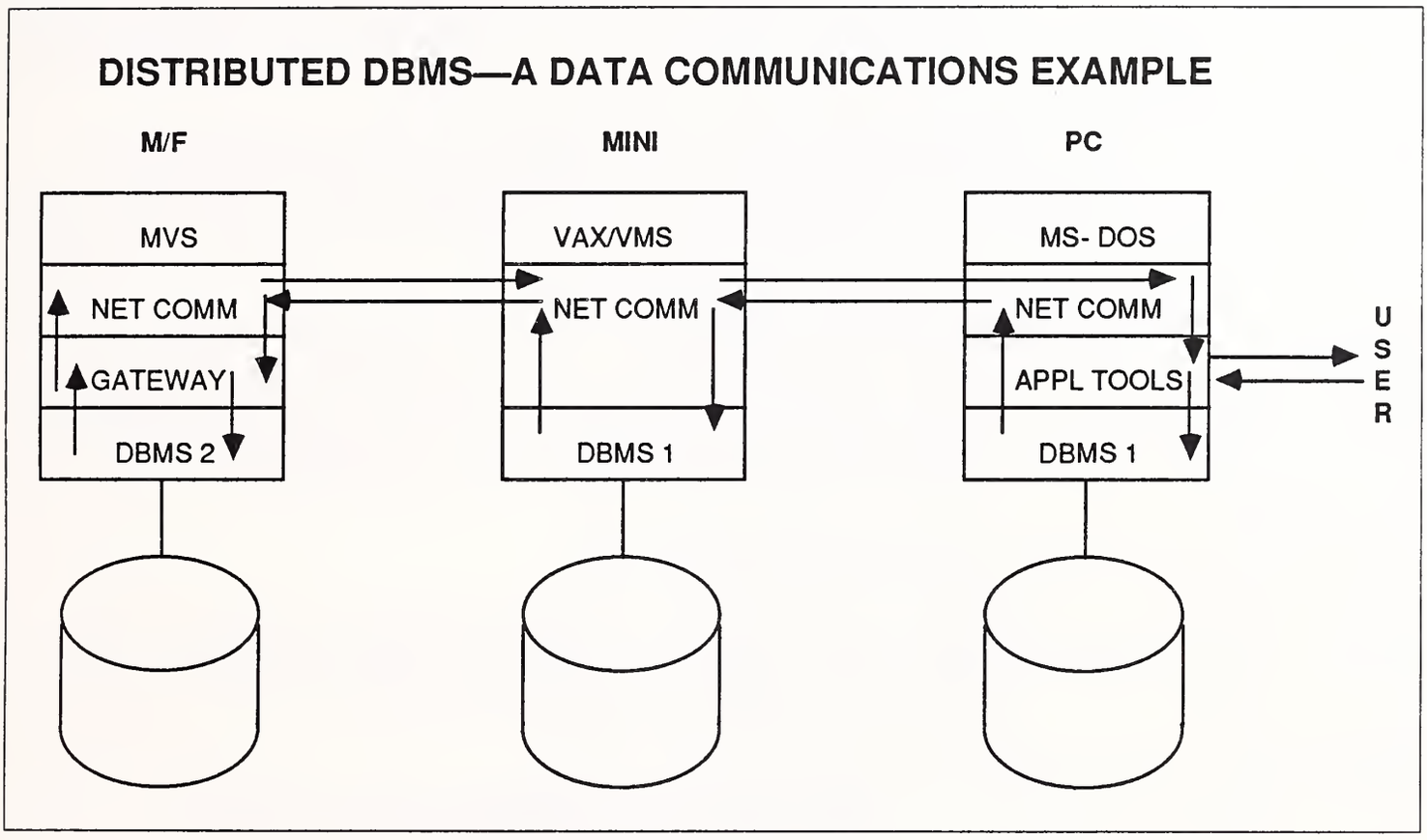


Exhibit V-2 provides a second example and shows the complexity of a potential DDBMS environment. In this example, the data base actually consists of relationships across platforms and different DBMS systems.

EXHIBIT V-2



The DDBMS manages those data relationships and interfaces with the communications capabilities of the DDBMS to access the other DBMSs when a transaction requires such access.

This heterogeneous environment, once achieved, provides significant data administration and management control benefits while improving data access for the user.

The use of a DDBMS to accomplish this cross-data base access shifts some of the control and design responsibility from the applications staff, who might design a file transfer program, to data administration, who must now track and maintain relationships across DBMSs and platforms.

The implications of this technology for data administration are significant.

- First, DDBMS provides a tool to meet distributed processing requirements while permitting centralized administration of all data within an application. This eliminates the need for file transfer, as well as the

exposures of redundant data stored by different data management technologies.

- Second, the user of the application can be provided an easy-to-understand relational data model with broad access without having to know where the data is actually stored. The DDBMS takes care of knowing where the data is and how to access it.

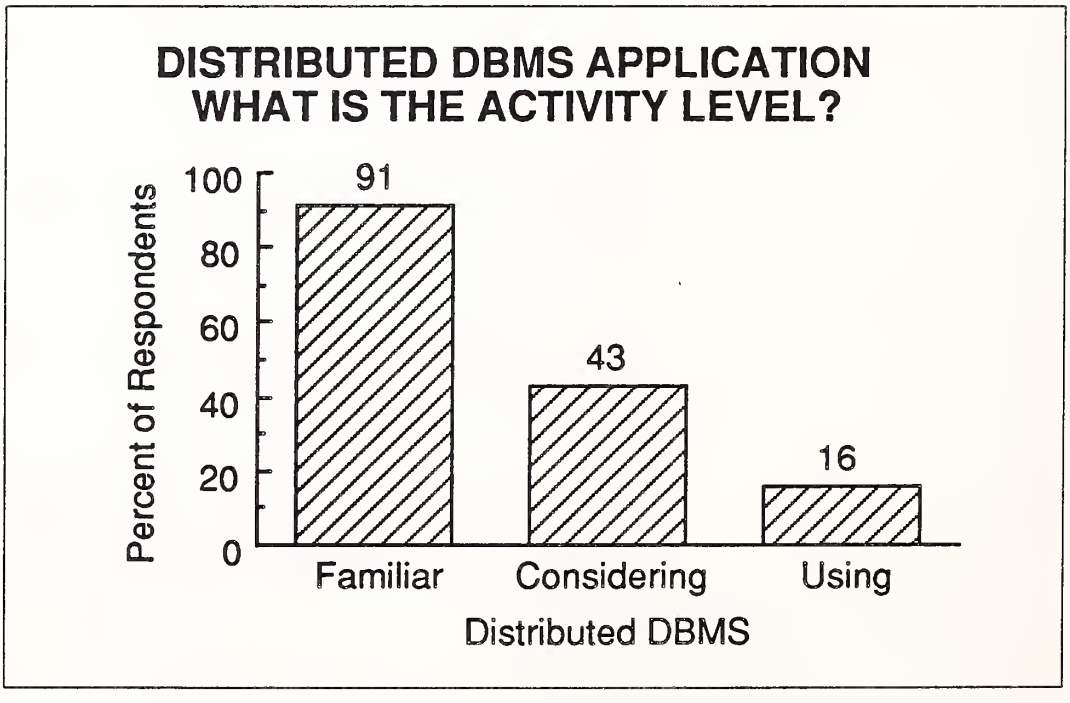
- Third, because the application will have some data redundancy for processing efficiencies, and because the application will change over time, the data modeling and administration will be much more dynamic than in a single platform application.

- Fourth, data administration's role in the application design and maintenance processes is increased. Data administration must have a larger understanding of the application and may make a larger contribution to the final design concept and specifics. The implication is a broader set of skills and increased demands on the time of the DBA staff.

1. Use of Distributed DBMS

Exhibit V-3 provides INPUT's findings on the level of activity with DDBMS. The concept has existed for a number of years, thus there is a very high level of familiarity and general interest.

EXHIBIT V-3

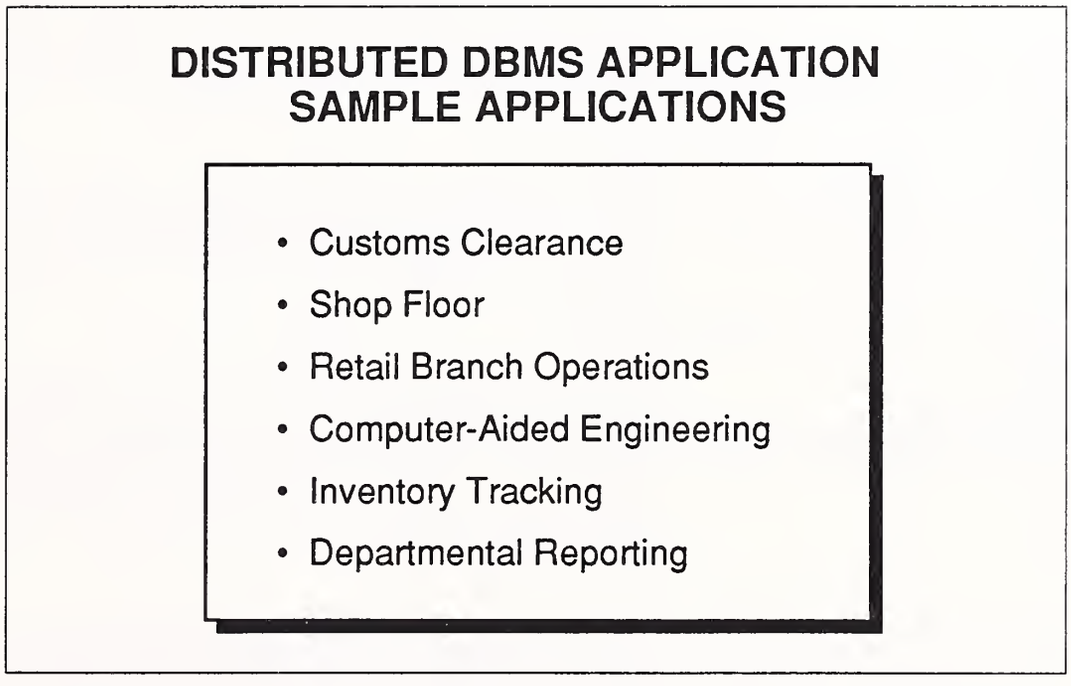


Four out of every ten data managers interviewed indicated DDBMS was under consideration. Given that the technology is relatively new and still contains some shortcomings, the number actually using DDBMS does not match this level of interest.

Although some 16% of those interviewed indicated they were currently using DDBMS technology, a closer look at the DBMS systems in use and the specific application showed that many of the applications were actually traditional distributed processing systems, which did use a DBMS on each of the platforms but not as a true distributed single data base.

Exhibit V-4 lists sample applications that are using DDBMS capabilities to some degree. It is of note that the applications are primarily operational, when the value of having the data geographically dispersed can be achieved while maintaining a single physical data base design.

EXHIBIT V-4



The vendors leading the way with DDBMS are the leading-edge RDBMS developers, specifically Oracle and Relational Technology. Both have had workable DDBMS capabilities on the market since mid-1987. The distributed module is part of the standard system and includes all of the portability characteristics that have helped these two companies become very successful.

Other vendors with DDBMS capability include:

- ADR, with Datacom/DB on IBM mainframes
- Tandem, with NonStop/SQL for transaction-based systems on Tandem computers
- Software AG, with Adabas

Others are expected to enter the market, including IBM—which will include some distributed capabilities in the next release of DB2.

The technology is available and can be used for certain types of applications. The vendors are working to meet the set of "standards" from Date and Codd and to develop interfaces with other relational and traditional DBMS systems so a heterogeneous system can be built using more than one DBMS technology.

2. Integrated Workstation Applications

Early in 1988 INPUT published a series of reports entitled, *Workstation Strategies*. These reports were a result of research into the changing technology and role of the general business workstation or computer terminal.

Not surprisingly INPUT found there are more personal computers in many companies than there are traditional terminals. Also, a majority of the PCs are already connected into the organization's information network.

In segment three of the series, *Workstation Strategies, Planning the Future*, INPUT explored the concept of integrated workstation-based applications. The concept is simply to use the unique capabilities of the PC or other intelligent workstation to perform portions of an application and the central processor (minicomputer and/or mainframe) to perform other functions.

With the advent of computers such as workstations and technologies such as DDBMS, the traditional approach to application design, placing the entire application on a single computer, goes away. Instead the application can be spread across the network, using the best of each tier's computing capabilities. Electronic mail and executive information systems are examples of early attempts to do this.

Exhibit V-5 provides a possible distribution of system functions between the workstation tier and the central processor that would lead to an integrated workstation application.

Designing such applications will place increased dependence on the data base design; thus the data administrator will play a larger role in their creation.

EXHIBIT V-5

INTEGRATED WORKSTATION APPLICATIONS DISTRIBUTION OF FUNCTIONS

Workstation	Central Processor
User Interface	Main File Maintenance
Data Entry and Verification	Application Network Management
Secondary Data Management	Primary Data Management
	Primary System Output
Current Activity Analysis and Reporting	Weekly, Monthly Processing
Ad Hoc Analysis	Backup, Security, etc.

B

Data Base Computers

The progress in the use of data base computers, such as Teradata, has been relatively slow and primarily tied to major high-volume applications where quick and almost random data retrieval is required. Data base computers tend to use the relational model and will become more important as the general use of RDBMS technology grows.

Their use will be decided on an application basis, yet it must be understood that such a decision introduces another DBMS technology that must be understood by the data administration function. Once the application is built, it may fall directly to a DBA to oversee the successful use of the data base computer and its application.

C

Role of the Data Dictionary

The data dictionary seems to be a long-sought-after and often undervalued tool to aid the data administration and management processes.

During its research INPUT interviewed one manager of data management who indicated that, in the past year, his company had achieved the goal of a 100% complete data dictionary and then, in the first cost reduction effort a few months later, had dropped the use of the data dictionary and decentralized the data administration process to the various application

development groups. In one quick decision, this company undermined the tool and the infrastructure they need to meet the systems integration required in the 1990s.

This singular instance may be not so isolated. As we reported in Chapter III, the level of effectiveness and use of data dictionary technology is relatively low. Certainly IBM and other mainframe DBMS developer's inadequate products have been a hindrance to the disciplined use of the data dictionary concept; however, more likely it is the lack of overall commitment and required resources that have lead to this performance level.

As highly integrated yet distributed information environments evolve, with computers at each tier of the network, data dictionaries, even in their simplest form, will be required.

Many of the new RDBMS systems include an integrated data dictionary that provides much of what is required. Vendors such as Oracle and Relational Technology are setting examples for the others.

D

Data Administration and CASE

Computer-assisted systems engineering (CASE) technology has significant meaning and impact for the data administration function. First, the technology brings with it new data administration tools, and second, the technology will support the eventual re-engineering of major applications as they are moved to new technology.

1. The Repository

Exhibit V-6 provides a schematic of a complete CASE system. The most important part may prove to be the automated repository. This tool is the core of the integrated CASE (I-CASE) system, as it provides the controls and documentation for the system.

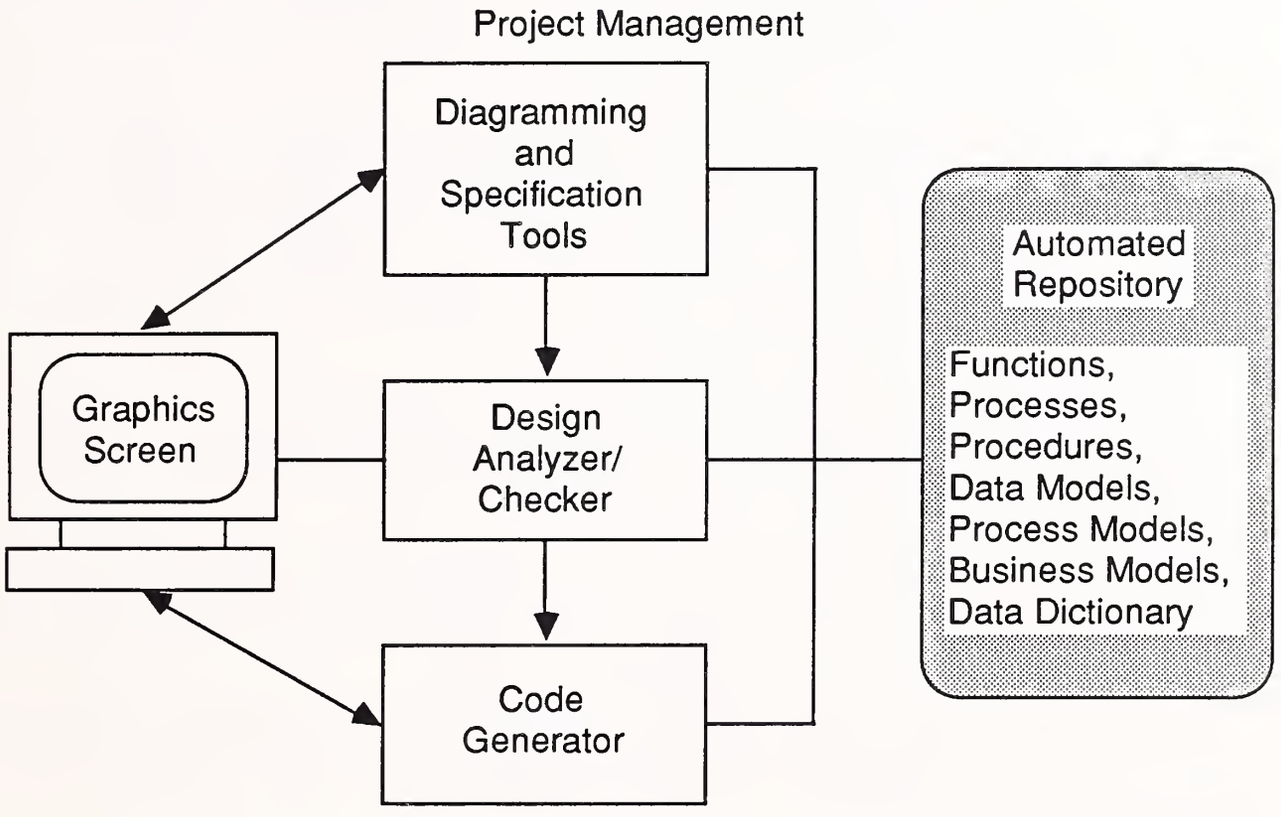
The repository is a data dictionary, a recorder of data and logic relationships, and the source of previously used code.

- Its role in a single-application development project is simply to control the process and leave behind a complete record of the application systems design, logic, data model, etc.

- Its role in serving a complete RDBMS installation of multiple applications is to provide everything a DBA ever wanted in a data dictionary and much more.

EXHIBIT V-6

COMPLETE CASE SYSTEM—A SCHEMATIC



Repository technology remains in early development.

- The front-end CASE vendors include a repository with their design tools, but it is not tied into the actual code development technology or DBMS.

- IBM has made public commitments to a repository for DB2 and an eventual solution for CASE, but has not released any product(s).

- The leading RDBMS vendors include an integrated data dictionary in their DBMS technology and are beginning to build CASE tools. It is only natural that their data dictionaries will be enhanced towards the repository definition.

The repository will be the tool that builds a solid interactive interface between systems development and data management. The technology will develop quickly in the next few years and should be adopted as soon as it proves practical.

2. Re-Engineering Tools

Some of the CASE vendors are addressing the development process from the re-engineering viewpoint. Believing that much of future development will be the re-engineering of existing applications into larger, more complex, and integrated systems, they feel that CASE concepts and technology should use re-engineering as a foundation.

Bachman Information Systems has recently released its first tools to support the re-engineering process. These tools are designed for use by the data manager and the DBA, not the application designer. Its philosophy is that the existing application(s) can best be understood from the existing data definitions and relationships, not the existing code and documentation. This will define the logic and establish a data model that can then be used in the new design.

Recognizing that many existing applications are poorly documented, this is a productive way to understand the underlying logic that must be modified or reprogrammed.

The alternative is to analyze the actual code. This approach seems more time-consuming and does not provide the underlying data model that is so critical.

Bachman is quick to point out that their tools can also be used for new application design, again using the data base and data relationships as the foundation.

Bachman offers a set of tools designed specifically for the data administration function that can help it gain an understanding of prior applications development, regardless of what data management technology was used. Using the Bachman technology just to "catch up" with history may prove valuable to some information systems organizations. Then if an application needs to be re-engineered or just maintained, there is a starting point at the very foundation of the application—the data definitions and relationships.

Data Management: Future Environment

VI

Data Management: Future Environment

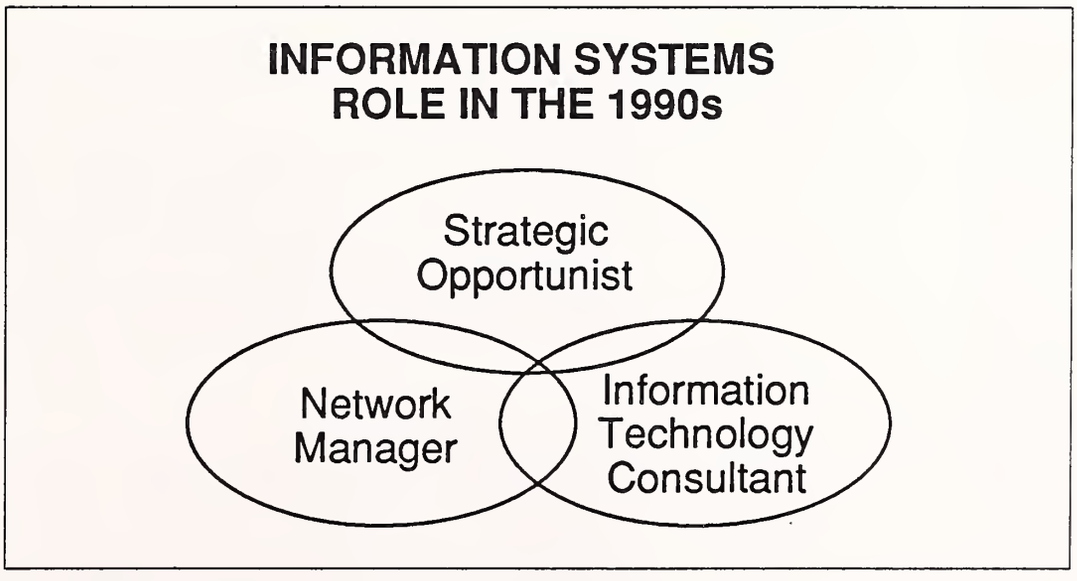
Exhibit VI-1 suggests three roles for the central information systems organization in larger organizations. These three roles as defined in INPUT's 1988 *Information Systems Planning* report.

1. The operational role of Network Manager, operating the information network but not necessarily all of the processing sites

2. The tactical role of Information Technology Consultant, providing the required architecture and infrastructure to the information environment

3. The strategic role of Strategic Opportunist, working with senior operations executives to identify and take advantage of information technology for the strategic success of the business

EXHIBIT VI-1



To a much greater extent than ever before, the central information systems management and staff must move away from much of the day-to-day operations and provide the overall architecture to permit maximum benefit from information technology.

The data management process is one of the underlying processes that central information systems must execute to achieve the expectations of the 1990s.

A Data Management's Role in the Organization

To place the future role of data management in perspective, it is appropriate to recount a little history.

- Prior to the arrival of computers and through the first fifteen years or more of their use, the controller of a business organization's information was the accounting organization, with the help of the internal auditing staff. The information that everyone used and that really mattered was the accounting records. Most operational information was used informally, was relatively imprecise, and was certainly not a full measure of the organizations performance.

- For operational processes outside accounting, the data contained in those systems began to take on an ownership of its own. It became common for an application to serve more than one department and for operational and accounting data to become intertwined.

- Soon operational data became more important than accounting data, and today operational data is the focus of most information systems activities.

- With the advent of data base management technology it became possible to integrate the data from many applications. Once DBMS technology was in common use, the data it stored seemed to become the computer's data, owned by information systems.

- The counteraction to this appearance of ownership by information systems was the tendency in the 1980s to distribute data to minicomputers and then to PCs. Very quickly in some companies small duplicate applications were created to permit a local department to own its data. At the minimum, significant effort was spent by both information systems and the user to install file transfer environments to move data down to departmental computers and workstations so it could be closer to the user. Significant expense has also been made to maintain integrity while increasing use of an organization's data.

- Much of this distribution of the computing process has been driven by improved user-oriented technology, greatly increasing the ease of use. Another driving factor has been the push by much of today's senior management to flatten organizations, reduce central staffs, and place increased decision making in the hands of line management. For these managers to operate their business unit they have taken an active role in the planning and deployment of information technology.

- While senior management supported this increased operational orientation to information technology, they did not plan for it to create chaos in the information network. Yet that is what happened in many organizations. So today, the cry is to integrate the information network while continuing to support operational demands.

The moral of this short story is that central information systems must provide an environment that permits smooth movement of data and information across the organization at all levels. A data architecture and the data management process are the means to do this, and technology is quickly improving to help meet this challenge. The data is needed at many levels of the organization, but information systems is the keeper of the keys and is the only company function that can fulfill this need. Fulfilling the need is therefore a primary role of information systems.

1. Elements of the Data Management Process

INPUT's definition for the data management process for the 1990s is three-tiered. Exhibit VI-2 diagrams that structure and suggests the primary functions that would be performed at each tier. This suggested concept is a delineation of the functions, not necessarily the separation of the organization.

EXHIBIT VI-2

DATA MANAGEMENT PROCESS FOR THE 1990s

Tier	Description	Functions
1	Infrastructure	Information Architecture Data Network Modeling Technology Selection
2	Definition	Definition Standards Definition Review Coding Schemes
3	Execution	Data Element Definition Design Execution DBMS Installation & Support

Once this delineation has been made, it becomes possible to consider how the functions will be performed. Separating the data administration organization to parallel the three tiers may be appropriate if the group is large and there is precedence in other areas of information systems. Not separating it may be appropriate as the charter of data administration is expanded to data management to assure all functions are performed compatibly.

A critical element of future success for data management includes involvement by the end user more directly in the data management process at all three tiers.

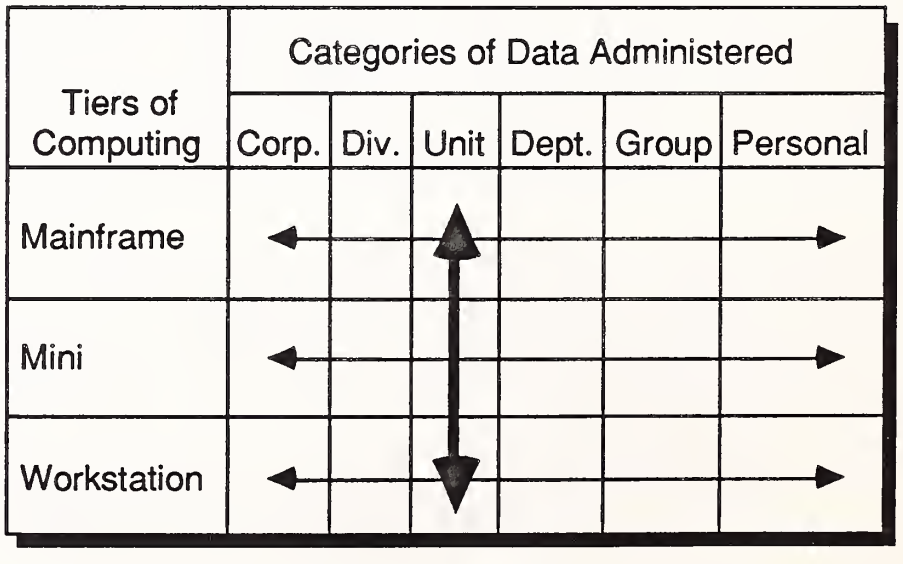
- At tier one, user management must understand how the overall architecture supports the business structure and strategy.
- At tier two, it is the user who must define the data elements, but must do so within a process that supports organizational as well as departmental use.
- At tier three, as RDBMS use becomes common at the minicomputer and workstation levels , the user must begin to assume a growing responsibility for execution of the DBA process.

2. Breadth of the Data Management Process

In Chapter III we reported findings concerning the breadth of the data management responsibility today (refer to Exhibit III-8). The findings suggested that broad responsibility was becoming recognized if not practiced. Exhibit VI-3 diagrams the breadth of the data management process.

EXHIBIT VI-3

DATA MANAGEMENT BREADTH OF RESPONSIBILITY



Over time the data management process must parallel the information network. This means it must extend across all three tiers of computing and from the corporate level to the personal level to structure the flow of data across the organizations. Only personal systems that do not exchange data with other systems, data bases, or levels of computing can fall outside the general data management process. Who performs the DBA tasks at each level is not the issue; it is that the data definitions and relationships are tracked and are part of an integrated infrastructure that meets the needs of the organization as well as the individual.

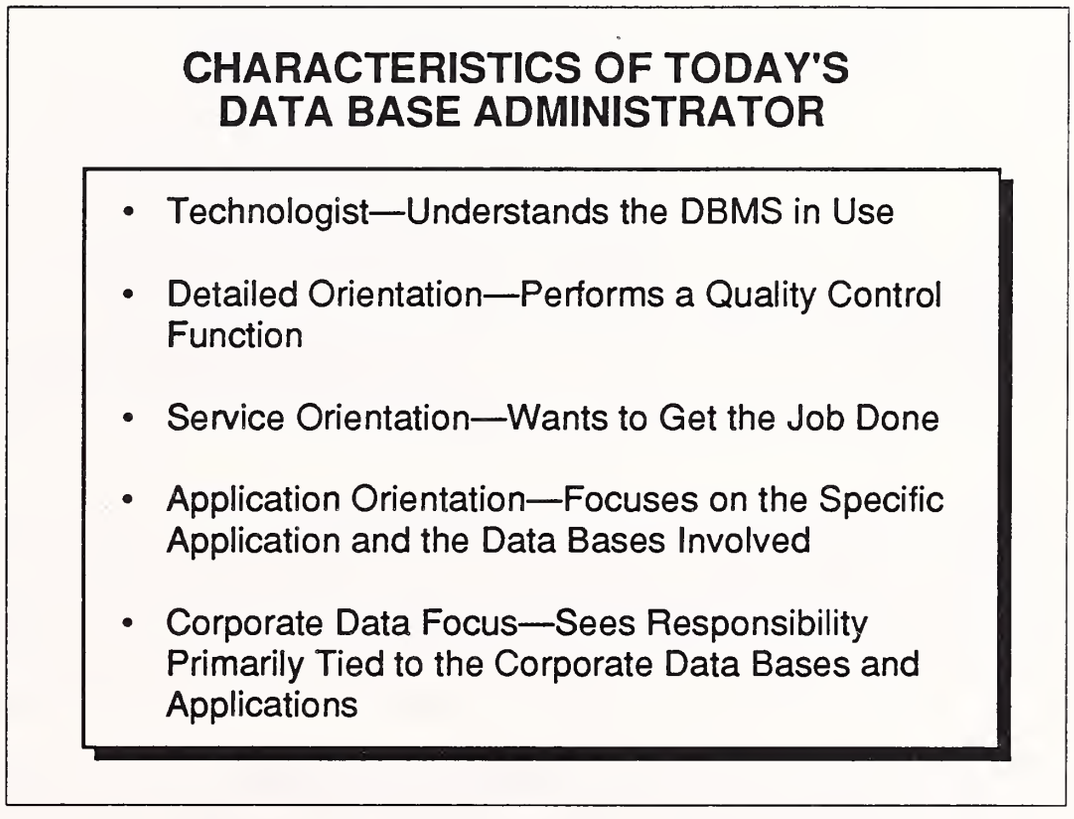
Understanding the breadth of the data management responsibility is critical to its future success and to how the process is established and evolved. The responsibility also dictates many of the needed characteristics of the individual who would lead data management.

3. Characteristics of a Data Manager

To define the characteristics of a data manager, it is first appropriate to characterize today's data base administrator.

Exhibit VI-4 lists those characteristics.

EXHIBIT VI-4



The new data manager's responsibility is much broader and implies a different set of characteristics, as suggested in Exhibit VI-5.

EXHIBIT VI-5

CHARACTERISTICS OF THE 1990s DATA MANAGER

- Generalist—Understands the Value of Information Technology and Can Market Its Value.
- Broad Picture—Has Top-Down View of the Information Infrastructure of the Organization
- Consulting Orientation—Advises the Development and Data Administration Groups on Specific Development Projects
- Business Data Orientation—Views the Data and Information Flow across the Entire Organization
- Systems Integration Focus—Focuses on Data Sharing by Groups of Applications in Support of a Strategic Business Operation

The differences are meant to be significant, as the task described earlier is a major one. Exhibit VI-6 compares the characteristics. The lists are not complete, but the differences are apparent. Selecting an individual to perform the broad data management task will prove to be one of the most important information systems assignments over the next few years.

EXHIBIT VI-6

DATA MANAGER VERSUS DATA ADMINISTRATOR—A COMPARISON

Data Manager	Data Administrator
Generalist	Technologist
Broad Picture	Detailed Orientation
Consulting Orientation	Service Orientation
Business Data Orientation	Application Orientation
Systems Integration Focus	Corporate Data Focus

B

Roadblocks to Success

Achieving this expanded role for the data management function is not an easy one and will take much of the first half of the 1990s to accomplish. There are many roadblocks. INPUT believes that those listed in Exhibit VI-7 are the most significant.

EXHIBIT VI-7

FUTURE DATA MANAGEMENT ROLE INHIBITING FACTORS

- Who Owns the Data
- Skills of Today's Data Administrator
- Status of the Information Network
- Status of DBMS Technology
- Understanding the Need
- Training of the End User

1. Who Owns the Data?

Our introduction to this section suggests that the concept of data ownership has become overshadowed by information technology. It certainly was not an issue prior to the use of computers. Today, however, it is often a smoldering issue that underlies many of the information technology decisions that are being impacted by the end user.

Sensing freedom from the central information controllers, the end user is quick to ask that the data be transferred to his own computer, or if possible, that the entire application be distributed. Not understanding and not being able to use the technology used to process data has lead to an "I would rather do it" phenomena: "I will have my data and the others can have theirs."

This may be a little over-simplistic perhaps, but true. Information systems is going to have to back up and build a framework under which ownership is apparent. It falls to the most appropriate end user, and the infrastructure supports easy sharing with others.

One step to doing this is to begin to transfer some of the detailed data administration tasks to unit information and end user functions.

2. Skills of Today's Data Administrator

Like most positions in information systems, the data base administration job evolved out of a technological need. Someone had to understand and execute the technology for data base applications, and a new information technology specialist was born.

Very few information systems organizations have provided the data administration function with the stature of other functions, such as application development; nor have they seen fit to place someone with a broad technical, let alone a business, orientation in the manager's position.

- One result is that most data administration functions have evolved along technical lines. Many data administrators would not even think about considering the user in the data design process.

- Another result is that the data administration process is viewed as a technical necessity rather than a process that can benefit all users of the information network.

- A third result is no one is that marketing the data administration process as one of the underlying elements of a successful information systems strategy. Unless the senior information systems executive is fulfilling that role, it is not being performed.

- A final result is that no one is preparing the end user to share in the responsibility and benefits of the data management process.

3. Status of the Information Network

The 1980s have been far-reaching years for the information networks of most large organizations. Traditional DBMS technology controls the central systems, departmental minicomputers are abundant, the PC is commonplace and is the user's computing standard, and the local area network is becoming common. All of this is interconnected but is far from integrated.

Information technology is how businesses are operated and managed, and users are quickly becoming the decision makers on many, if not most, major decisions. However, the available information has not satisfied the appetite of management, and the network is not truly open to the end user.

4. Status of DBMS Technology

The relational DBMS technology is becoming viewed as a truly new and better answer for many computing requirements and has the opportunity to be based on an industry-wide standard, making interfaces far simpler. Once all is in place, a major hurdle will have been passed.

However, information systems is just beginning its move into RDBMS, has the user to train, and has much to learn. It also carries ten to fifteen years of investment in traditional DBMS technology. The typical data manager simply sees a major technical task ahead and is not able to rise to the broader aspects of the data management process.

5. Understanding the Need

Understanding the need for a broad, organization-wide data management process is difficult for general management and even some information systems executives. In an era when corporate staffs and central control is not the preferred style of management, something that appears as abstract as a corporate data architecture is a tough sell.

Information systems must recall the original effort it needed to sell the first DBMS project and the inherent technology investment. General management certainly did not understand the need. The sales effort for a data management process is the same type as before, only with a different investment and impact.

6. Training of the End User

At times it seems that the primary objective of the information center has been lost in the flurry of PC and 4GL activity over the past few years. Its objective is to serve as the primary moving force behind increasing the end user's involvement in the use of information technology. Too often it has served as the controller of that use.

The information center, and information systems in general, has not trained the user and its management about the fundamentals of information technology. The training required ranges from analysis and design, to data base concepts, to operations and security. Until it starts to do this, other aspects of the central information system's role for the 1990s, including data management, will be met with some resistance.

C
Developing a Roadmap

Once the concept of data management versus data administration is accepted, the task will be significant and the steps many. Some have already begun to address this issue, but few have achieved the desired result.

In INPUT's 1988 *Information Systems Planning Report* a series of priorities for 1989 and beyond 1989 were suggested. In the data management area, the priorities were:

- For 1989—Audit the data management function.
- Beyond 1989—Refocus data management to a company-wide orientation.

1. Audit Data Administration

Certainly, an audit is the starting place. Most data administration functions are ten years old, or older, and will benefit from a complete examination.

- The two data administration questionnaires in this report would be a reasonable first effort to establish a benchmark versus our broader research.

- The audit is designed to document the true state of data administration and to build a foundation for planning.

2. Planning for Change

Building a plan of action is the second obvious step. While the starting point for the plan will vary with current status, it will need to include the elements in Exhibit VI-8.

EXHIBIT VI-8

PLANNING FOR THE DATA MANAGEMENT FUNCTION OF THE 1990s

- Organization-wide Charter
- Marketing Program
- User Education Program
- Multiyear Structure
- Technology Assessment and Architecture
- Policy and Procedure Process

Organization-wide Charter—Gaining an initial consensus among involved information systems and end user groups starts with the definition of a charter for the data management process. Once there is an overall charter, it is possible to define the various roles.

Marketing Program—Gaining the needed acceptance suggests an internal marketing plan designed to spread the word about potential benefits, define the requirements, and launch the education process.

User Education Program—The training emphasis of the user must now go from process to concept. Data management and DBMS technology are the logical starting points, as these are the core of the information network in the eyes of the user.

Multiyear Structure—The task will be a long one, and patience is required. Define the building blocks and stick to a plan. Caution is appropriate for as long as progress is being made.

Technology Assessment and Architecture—The data manager needs to understand all of the data management technology that is in use and then build a compatible architecture within which future decisions will be made. DBMS technology is evolving, thus the architecture must evolve with it; yet without a benchmark, there is no basis to assess the impact of adding new technology.

Policy and Procedure Process—By the time the full data management process is in place, the execution task and some of the definition tasks will be decentralized, probably all the way to the end user. Thus, an appropriate set of policies and procedures must be put in place over the first two years of this effort.

No one in the organization is going to tell information systems to launch a data management process. Information systems must decide themselves that data management is a service that the organization requires and that it is their responsibility to provide it. The value will become apparent over time.

3. Shifting Responsibility to the End User

As more and more information processing is performed at the second and third tiers of the network, the user is going to have a greater impact on data base design and use. It is only natural, therefore, to begin to place some of the data administration responsibility in the user's hands. To start this process, information systems must recognize and pursue the following.

- The need for conceptual training has already been discussed.
- A movement towards SQL-based personal computer data base products is an important step both in simplifying data movement and in the user's understanding of RDBMS and data base technology in general.
- The ownership question can best be addressed by allowing the user to define the data elements of an application with information systems, with data management supporting the process. Over time the user will then be more able to assume some of the DBA tasks.

Conclusions and Recommendations

Conclusions and Recommendations

A Conclusions

Many of the conclusions from this study are straightforward, but at the same time, far-reaching. The data management function is on the verge of major change. Information systems management must recognize the change and act on it now, not later.

- The underlying technology used for data base applications is changing rapidly to relational DBMS.
- The end user is learning, often by himself or from the vendor, to use RDBMS capabilities.
- RDBMS capabilities are available on all three tiers of the information network: mainframe, minicomputer, and workstation. Data base applications are being developed at all tiers.
- Relational DBMS technology will bring many advantages that have not been fully satisfied by traditional DBMS technology. This will provide information systems and the data management process with a opportunity to increase control as well as access to the information in the network. Features of RDBMS include:
  - A standard base language, SQL
  - Portability across the tiers of the information network
  - Initial and simple understanding of the technology by the end user. A RDBMS view of data relationships is a two-dimensional table.
  - Integrated data dictionaries
- External technologies, such as CASE, are impacting the development process and therefore data administration.

- Relational technology remains new with many improvement to be made. As it evolves, new types of applications will be possible. An ever-changing data infrastructure will result, necessitating an expanded orientation by the data administration function.
  - The advent of distributed DBMS capabilities will revolutionize the way in which many applications are designed.
  - The ease with which regional data bases can be modified and accessed will permit applications that previously were just too costly; for example, executive information systems.
- The priorities for the next few years will be to interconnect the information network while maintaining its distributed structure. New DBMS technology and a proactive data management process are essential to meet this goal.

B Recommendations

INPUT offers the following recommendations for the data management area. As with its other assessments for information systems management, INPUT provides both a short and long-term set of priorities.

The fundamental recommendation is that information systems must realize that the traditional data administration process is not longer adequate to both serve and help control the information network. It is essential that a broader view be assumed by information systems and a top-down data management process evolve over the next few years.

1. Data Management Objectives for 1989

The following objectives are recommended to information systems management concerning the current data administration function for 1989.

- Audit the data administration process to provide a benchmark for expanding the framework of the process.
- Define a data management charter as a foundation for broadening the orientation and to market concepts to users and senior management.
- Select a SQL DBMS for PC use. The users learn best through trying and using the technology. The sooner they begin to understand RDBMS in their environment, the PC (workstation), the sooner it will be possible to move to conceptual training on data base technology. Once users learn SQL-based languages and concepts, they can take on greater responsibilities in the data administration level.

- Re-emphasize the data dictionary, as this tool will be an essential element of a RDBMS and DDBMS-based environment. It will also make the adoption of CASE technology and systems integration much more achievable.

- Introduce a generalist into the data administration function. The information center, and information systems in general, has benefited from management by a more business-oriented, versus technically oriented individual; similarly it is time to add these skills to the expanding data management function. Such a move will quickly broaden the orientation of the data administration staff and improve communications with those served.

- Audit the use of minicomputer DBMS systems to be sure the activity is compatible with longer range integration plans. If data administration is not directly involved with this use of minicomputer DBMS technology, it should do so immediately.

2. Data Management Objectives beyond 1889

The following objectives are recommended as data management priorities beyond 1989 and into the next decade. They all presume that a full data management process will be the objective.

- Broaden, over time, the responsibility of the data management process to all levels of the information network.

- Launch a user training program in all aspects of data base use. This understanding is fundamental to meeting the broader goals of information technology use throughout the organization. It is through data base technology that end users will reach their desired sense of information freedom, while information systems will provide the connectivity and integration required for the organization to be successful.

- Develop a data architecture, and have it accepted by user management. Users must understand it and how it fills their needs, not those of the information systems group(s).

- Market the data management process at all levels of the organization. This is a service from information systems to the rest of the organization that, if performed successfully, will strengthen computer-based information use and capabilities throughout the organization.

- Begin to segment the data management process for the eventual shift of some tasks to unit and end-user information systems groups, and shift the responsibility as soon as the functions are prepared to accept it.

- Explore the impacts of CASE on the data management and administration processes. CASE technology will bring tools to support the data administration and expanded data management processes.

- Support experimentation with distributed DBMS. This extended capability of relational DBMS will eventually provide the control mechanism required to permit a true balance between data management control and freedom of data use by the user.

Appendix: Data Administration Questionnaire

Appendix A: Data Administration Questionnaire

INTRODUCTION

A. Hello, my name is _____. I am calling for INPUT a leading market research firm specializing in the information systems industry. I would like to speak to the individual responsible for the data administration function (that is; the Data Base Administrator, or Manager of Data Administration or Data Management). Could you direct me to that individual? **If switched elsewhere for referral, repeat as necessary.**

B. Hello, my name is _____. I understand you are responsible for the data administration (or data management) function. I am calling for INPUT a leading market research firm specializing in the information systems industry and would like to ask you a few questions.

Would you have a few moments now, or would you prefer that we set an appointment for another time? It should take only 10 minutes and INPUT will be pleased to share a summary of the results with you. **If the correct person proceed to C or make an appointment to call back, otherwise transfer and repeat.**

C. We are currently studying a number of issues in the data administration area of information systems, in particular the use of relational data base management systems and the use of data dictionaries. Your responses to the questions will be kept confidential and, as I mentioned, INPUT will send you a complimentary summary of the results.

Individual Completing the Questionnaire

Name _____
Title _____
Organization _____
Address _____
_____
Telephone _____

The first group of questions address the data administration organization.

QU: 1a What is the number of employees in the data administration staff?
1987 ____ 1988 plan ____ 1989 estimate ____

QU: 1b Is there more than one Data Administration organization?
Yes ___ No ___ **GO TO 2**

QU: 1c How many separate data administration organizations are there within your firm? ____

QU: 1d Please describe each one?

Data Administration Organization	Reports To
_____	_____
_____	_____
_____	_____

QU: 1e Which of the following categories of data is the corporate data administration function responsible for? **READ THE LIST**

Central Data	Y N
Division Data	Y N
Departmental Data	Y N
Distributed Systems	Y N
Minicomputer Data Bases	Y N
PC Data Bases	Y N
Non Data Base Systems	Y N
Other (_____)	Y N

QU: 1f How have these responsibilities changed in the past year?

_____

_____

QU: 1g What are the top three issues facing your data administration function?

1. _____

2. _____

3. _____

QU: 1h On a scale of one to five how would you rate the effectiveness of the corporate data administration function today? Five indicates excellent performance and one poor performance.

1 ____ Poor
2 ____
3 ____ Average
4 ____
5 ____ Excellent

Next, I would like to learn which data base management systems (that is DBMSs) are in use, and what the primary applications are for each, for mainframes, minis and personal computers.

QU: 2a First, what DBMSs are in use on your mainframe(s)?

	DBMS	Primary Use/Applications
1.	_____	_____
2.	_____	_____
3.	_____	_____

QU: 2b Next, minicomputers?

1.	_____	_____
2.	_____	_____
3.	_____	_____

QU: 2c And finally, personal computers?

1.	_____	_____
2.	_____	_____
3.	_____	_____

QU: 2d Are any new DBMSs under consideration?
Yes ___ No ___ **GO TO 3**

QU: 2e Which ones and for what applications?

DBMS	Applications
_____	_____
_____	_____

The third set of questions address your use of relational data base management systems.

QU: 3 Has your organization developed any relational DBMS based applications?
Yes ___ No ___ **GO TO 5**

QU: 4 **USING THE FOLLOWING TABLE ASK:**

QU: 4a What applications have been developed using a relational DBMS? **TRY FOR MORE THAN 1 EXAMPLE**

FOR EACH APPLICATION MENTIONED IN 4a ASK:

QU: 4b What relational DBMS was used?
QU: 4c What computer (mainframe, mini, or PC) was used?
QU: 4d When were they developed?

Application Name	4b RDBMS Used	4c M/F Mini PC	4d When Developed
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

QU: 5 **USING THE FOLLOWING TABLE ASK:**

QU: 5a What applications are planned for development using a relational DBMS in the next two years? **TRY FOR MORE THAN 1 EXAMPLE**

FOR EACH APPLICATION MENTIONED IN 5a ASK:

QU: 5b What relational DBMS will be used?

QU: 5c What computer (mainframe, mini, or PC) will be used?

QU: 5d When will they be developed?

Application Name	5b RDBMS Used	5c M/F Mini PC	5d When Developed
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

QU: 6 Of all new application development projects, what percentage would you estimate will be done using a relational DBMS in 1988 and 1989? Please indicate by type of computer. **PROBE FOR A GUESS.**

	Percent of All New Development	
	1988%	1989%
Mainframe	____%	____%
Mini	____%	____%
PC	____%	____%
Total	100%	100%

Now, I would like to ask about the involvement of the end user in application development.

QU: 7 Are end users developing applications using relational DBMS systems?

Yes ___ No ___ **GO TO 10**

QU: 8 **USING THE FOLLOWING TABLE ASK:**

QU: 8a What applications have been developed by end users with a relational DBMS? **TRY FOR MORE THAN 1 EXAMPLE**

FOR EACH APPLICATION MENTIONED IN 8a ASK:

QU: 8b What relational DBMS was used?

QU: 8c What computer (mainframe, mini, or PC) was used?

QU: 8d When were they developed?

Application Name	8b RDBMS Used	8c M/F Mini PC	8d When Developed
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

QU: 9 What criteria was used to determine that end users were equipped to do their own relational DBMS based development?

_____

The next few questions concern your use of distributed data base management systems.

QU: 10 **IF NO TO 7 ASK** Are you familiar with distributed data base management system concepts?
Yes ___ No ___

QU: 11 Is Distributed Data Base Management Systems (DDBMS) technology in use within your firm?
Yes ____ No ____ **GO TO 13**

QU: 12 **USING THE FOLLOWING TABLE ASK:**

QU: 12a What applications have been developed using a distributed DBMS? **TRY FOR MORE THAN 1 EXAMPLE**

FOR EACH APPLICATION MENTIONED IN 12a ASK:

QU: 12b What distributed DBMS was used?

QU: 12c What computer (mainframe, mini, or PC) was used?

QU: 12d When were they developed?

Application Name	12b RDBMS Used	12c M/F Mini PC	12d When Developed
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

GO TO 14

QU: 13 IF NO TO 11 ASK Is distributed DBMS under consideration?
Yes ___ No ___ **GO TO 15a**

QU: 14 **USING THE FOLLOWING TABLE ASK:**

QU: 14a What applications are under consideration that will be developed using a distributed DBMS? **TRY FOR MORE THAN 1 EXAMPLE**

FOR EACH APPLICATION MENTIONED IN 14a ASK:

QU: 14b What distributed DBMS was used?

QU: 14c What computer (mainframe, mini, or PC) was used?

QU: 14d When will they be developed?

Application Name	14b RDBMS Used	14c M/F Mini PC	14d When Developed
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The last few questions address your use of data dictionaries.

QU: 15a Does your firm use a data dictionary?
Yes ____ No ____ **GO TO 16a**

QU: 15b What data dictionaries are in use and what data bases do they cover?

Data Dictionary	Data Bases Covered
_____	_____
_____	_____
_____	_____

QU: 16a Please estimate the percentage of your data bases that are administered using a data dictionary? ____%

QU: 16b How would you rate the quality of your use of these data dictionary capabilities?

___ Excellent
___ Above Average
___ Average
___ Below Average
___ Unsatisfactory

QU: 17a Are you planning to install a data dictionary?
Yes ____**GO TO 18** No ____

QU: 17b If No, why not?

_____

_____

GO TO 19

QU: 18 **USING THE TABLE BELOW PLEASE ASK THE FOLLOWING QUESTIONS:**

QU: 18a What data dictionaries are planned?

FOR EACH DATA DICTIONARY MENTIONED IN 18a ASK:

QU: 18b When do you plan to implement these dictionaries?

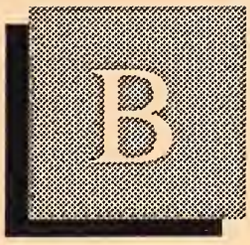
QU: 18c What data bases will they cover?

18a. Data Dictionary	18b. When Implement	18c. Data Bases
_____	_____	_____
_____	_____	_____
_____	_____	_____

QU: 19 Finally, would you (or the manager of data administration) be willing to participate in a more in depth interview at a future date?
Yes____ No____

Name _____
Title _____
Phone No. _____

That's it! I want to thank you for your help today. Let me double check your address in order to send you a synopsis of the report. Thanks again.



Appendix: Data Administration Questionnaire #2

Appendix B: Data Administration Questionnaire #2

INTRODUCTION

Hello, earlier in 1988 we talked with you or an associate about your data administration function and the changes it is undergoing. At this time I would like to take a few more minutes to explore some aspects of the data administration function that INPUT finds to be changing as we approach the 1990s and the age of relational and distributed data base technology.

Is this a convenient time?

The aspects I wish to discuss deal with the use of relational data base technology and the fundamental responsibilities of data administration and how they may need to change for the 1990s.

INPUT will be publishing its report on this research in December and will send you a copy of the Executive Overview.

First let me confirm a few characteristics of your current data administration environment.

QU: 1 You are currently using the following DBMSs.

_____
_____
_____
_____

QU: 1a Are any others in use? Yes____ No____

Which ones? _____

QU: 1b Are any others under consideration? Yes____ No____

Which ones? _____

QU: 1c How have the data administration responsibilities changed in the past year?

_____

_____

_____

QU: 1d How is the performance of data administration measured in your company?

1._____

2._____

3._____

QU: 1e What are the top three issues facing your data administration function?

1._____

2._____

3._____

QU: 1f What are the three top objectives for your data management function over the next two years?

1._____

2._____

3._____

QU: 1g On a scale of one (low) to five (high) please rate the quality of your use of data dictionary capabilities?

1 ___ Excellent
2 ___ Above Average
3 ___ Average
4 ___ Below Average
5 ___ Unsatisfactory

QU: 1h What plans exist to improve the use of data dictionary capabilities?

_____
_____
_____
_____

QU: 1i Who sets definitions for data in your organization?

User ___ Information Systems ___ Both ___

QU: 1j Who owns the data in your organization?

User ___ Information Systems ___ Both ___

QU: 1k Please describe what data ownership means?

_____

_____

_____

QU: 1l Please describe the policies that oversee data administration in your organization?

_____

_____

_____

QU: 1m Do these policies apply to ...

Corporate Departments	Yes ___	No ___
User Computing	Yes ___	No ___
Departmental Computing	Yes ___	No ___
Operating Divisions	Yes ___	No ___
Personal Computing	Yes ___	No ___

QU: 1n How would you rate, from one (low) to five (high) the level of compliance with the data definition policies?

1 2 3 4 5

Relational DBMS

Next, I would like to discuss your progress in the application of Relational DBMS technology? As noted previously you are using the following products.

QU: 2a Relational DBMS use?

Mainframe _____

Minicomputer _____

PC _____

QU: 2b When did the RDBMS use begin? _____

QU: 2c Is that use primarily?

Mainframe ___ Mini ___ PC ___

QU: 2d How many applications have:

1. Been developed? _____

2. Are in process? _____

QU: 2e What criteria is being used to decide to use a RDBMS versus a conventional DBMS?

1. _____

2. _____

3. _____

QU: 2f What has been the impact on the data administration regarding:

1. Training

_____
_____
_____

2. Data Modeling

_____
_____
_____

3. Data Administration/Data Dictionary

_____
_____
_____

4. Other

_____
_____
_____

QU: 2g Please rate the Productivity of Data Administration with RDBMS compared to conventional DBMS?

1. Is it?

Worse ____
Same ____
Better ____

2. How much better or worse?

10%____ 25%____ 50%____ 75%____ Other _____

QU: 2h Please rate the Productivity of application development personnel with RDBMS compared to conventional DBMS?

1. Is it ?

Worse ____
Same ____
Better ____

2. How much better or worse?

10%____ 25%____ 50%____ 75%____ Other _____

QU: 2i If using both mainframe and minicomputer based RDBMS systems please compare the activities/productivity/etc.?

_____
_____
_____
_____

End User Use of RDBMS

QU: 3a Are End Users developing systems with this RDBMS?

Yes ____ No ____ **(SKIP TO 4a)**

QU: 3b Is the corporate data administration group coordinating this use?

Yes ____ No ____

1. If No who is? _____

2. If Yes, how would you rate that coordination?

Less than Adequate ____
Adequate ____
More than Adequate ____

QU: 3c If yes, what are some examples?

1. _____

2. _____

3. _____

QU: 3d What type of training is being provided to the end users?

_____

_____

Personal Computer/Workstation DBMSs

QU: 4a What type of workstation-based DBMS activity is there?

_____
_____
_____
_____

QU: 4b Is the corporate data administration group coordinating this activity?

Yes ____ No ____

1. If No who is? _____

2. If Yes, how would you rate that coordination?

Less than Adequate ____
Adequate ____
More than Adequate ____

QU: 4c What are some examples of workstation-based DBMS use?

1. _____

2. _____

3. _____

Data Base Machines

QU: 5a On a scale of one (low) to five (high) how familiar are you with data base computers and their application?

1 2 3 4 5

QU: 5b Is a data base computer ....

1. In use in your organization? Yes ___(5c) No ___

2. Under consideration? Yes ___(5h) No ___

3. Under investigation? Yes ___(5h) No ___

4. Not considered applicable? Yes ___ No ___(5i)

QU: 5c When was it first acquired?

_____

QU: 5d Is the corporate data administration group coordinating its use?

Yes ____ No ____

1. If No who is? _____

2. If Yes, how would you rate that coordination?

Less than Adequate ____
Adequate ____
More than Adequate ____

QU: 5e What applications are supported by a data base machine?

1. _____

2. _____

3. _____

QU: 5f What data base computer is in use?

_____

QU: 5g What were the factors leading to the use of a data base computer instead of a DBMS?

1. _____

2. _____

3. _____

GO TO 6a

QU: 5h For what application(s) is data base computer technology being considered?

_____

1. When might a selection be made? _____

GO TO 6a

QU: 5i For what reasons is data base computer technology considered not applicable?

1. _____

2. _____

3. _____

Distributed Data Base Management

QU: 6a Is a distributed DBMS ...

1. In use in your organization? Yes ___(6c) No ___
2. Under consideration? Yes ___(6h) No ___
3. Under investigation? Yes ___(6h) No ___
4. Not considered applicable? Yes ___ No ___(6i)

QU: 6b Is the corporate data administration group coordinating its use?

Yes ____ No ____

1. If No who is? _____

2. If Yes, how would you rate that coordination?

Less than Adequate ____
Adequate ____
More than Adequate ____

QU: 6c What applications are supported by a data base machine?

1. _____
2. _____
3. _____

QU: 6d What distributed data base is in use?

_____

GO TO END

QU: 6e For what application(s) is distributed data base technology being consider?

_____

1. When might a selection be made? _____

QU: 6f For what reasons is data base computer technology considered not applicable?

1. _____
2. _____
3. _____

That's it! I want to thank you for your help today. Let me double check your address in order to send you an Executive Overview from the report.